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ABSTRACT

The study was designed to construct and evaluate a language inventory that would measure language ability of severely retarded children, aged 6 1/2 to 10 years. Five of R. M. Gagne's eight types of learning were chosen for identifying language ability, and eight subtests were developed to accompany these learning types. The subtests were stimulus response, motor imitation, vocal imitation, chaining objects, chaining actions, verbal association, multiple discrimination, and concept development. The language inventory was administered to 160 trainable mentally handicapped children, aged 6 1/2 to 10 years old. Based on the research findings, some tentative conclusions were drawn. The stimulus response subtest seemed to be too easy for most children. Little or no increase of mean scores was found for the chaining objects and chaining actions subtest. More complex tasks were needed on the motor imitation, vocal imitation, chaining objects, and chaining actions subtests to differentiate between the 8-6 and 9-6 age groups. Administration of the language inventory to 5-year-olds might be helpful. The size of subtest intercorrelations was found to increase with presentation of more complex types of learning. (CB)

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SOME PROCEDURES FOR EVALUATING LANGUAGE DEVELOPMENT IN YOUNG RETARDED CHILDREN

BY

MACK L. BOWEN
B.S., University of Alabama, 1965
M.A., University of Alabama, 1967

THESIS

Submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy in Education
in the Graduate College of the
University of Illinois at Urbana-Champaign, 1971

Urbana, Illinois

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CHAPTER I

INTRODUCTION

Importance of Language

The ability to use language, both receptive and expressive, is an important element in academic and social success. In general, school programs are developed around the acquisition, retention, and use of symbols. Programs in reading, writing, and receptive and expressive skills in spoken language all require certain levels of proficiency in the manipulation of various visual and auditory symbols. Johnson and Myklebust (1967) state that the child who does not comprehend the spoken word or perceive time and space is reduced in total experience, is emotionally immature, and lacks the usual tools for thought, understanding and adjustment. Likewise, if a child cannot make his physical or emotional needs known, he is severely handicapped, resulting in added demands upon parents, teachers, or child care workers. According to Vygotsky's (1962) analysis of language and thought, language is the basis for a number of cognitive functions such as reasoning, thinking, planning, organizing and problem solving. Deficiencies in language could cause observable deficits in these areas, the results being manifested as deviant or inadequate language behaviors.

Language and Mental Retardation

A number of research studies have been conducted with the intent of investigating various questions about language development and language functions in the mentally retarded. Various reviews (Matthews, 1957; Spradlin, 1963; Spreen, 1965) have indicated some interrelation between language and mental retardation.

While there is agreement among individual authors that no special type of language disability characterizes the mentally retarded, their studies, taken collectively, indicate that all types of speech and language impairments observed in normal and in other clinical groups are also observed in the mentally retarded. The classification of "retarded language development" is applied as a general term, covering the whole range of language dysfunction. The term, however, may be best reserved for children who show significant deviations from the average in several dimensions (Johnson, Darley and Spriestersbach, 1963).

Some studies have focused particularly on the relationship between language dysfunction and intelligence. Although results vary with the type of group under investigation, an inverse relationship between language handicap and intelligence is apparent. The frequencies reported are usually around 100 percent in groups below 20 IQ, around 90 percent in the 21 to 50 IQ groups, and around 45 percent in the mildly retarded groups (Abt, Adler and Bartelme, 1929; Karlin and Strazzulla, 1952; Schlanger and Gottsleben, 1957; and Spreen, 1965). Likewise, the onset of speech follows the same pattern. Mead (1913) and McCarthy (1946) estimate the onset of speech to be retarded by one year or more in retardates. Based on Berry and Eisenson's (1942) hypothesized "co-existence" of intelligence and speech development, a high correlation between vocabulary and IQ has been obtained repeatedly with retardates as demonstrated in studies of Sloan and Bensburg (1954) and Fisher, Shotwell and York (1960).

Incidence statistics of language dysfunction also tend to show that the mentally retarded group as a whole is impaired in language development. Onset of talking, speech sound development and acquisition of phonemes shows a low although consistently observed correlation with standard measures of intelligence. Speech productivity shows only a moderate relationship with both intelligence and vocabulary level.

It should be noted that the relationship between language retardation and mental retardation has been obfuscated due to the type of instruments used in making the evaluations. This is exemplified in the fact that many of the standard intelligence tests also measure verbal abilities, and many of the language measures (Bangs, 1961; Spradlin, 1963; Dunn, 1959) include techniques which are very similar to some intellectual measurements.

Mein (1961) and Lyle (1961), among others, have investigated the question of specific retardation in the language development of the mentally retarded in contrast to normal children of a comparable MA. Mein (1961) found that with increasing MA the percentages of nouns used by subnormals decreased in a way similar to that reported for normal speech development.

Lyle (1961), investigating the problem of whether the language handicap of retardates may be more severe than would be expected on the basis of the degree of intellectual retardation, assessed performance on common academic tasks (naming familiar objects, word definition, reproduction of speech sounds) by retarded and normal children. Retarded subjects were somewhat poorer than their matched normal controls on most of these tasks. For some of the tasks (object naming and speech sounds) this difference was greater at lower MA levels (2-6 to 2-11) than at higher levels (4-6 and above). Lyle concluded that for the retarded group the symbolic processes involved in verbal learning and reasoning lag behind other aspects of cognitive development.

In summary, these studies have found a lag of retardates in such measures as sentence length, sentence complexity, discrimination of speech sounds, vocabulary size, and noun percentage as compared to normal children with matched MA.

Research on language abilities of institutionalized mentally retarded populations has been reported. The findings have indicated that institutionalized retardates perform more poorly on language tests than children raised at home. The problem has been emphasized by Goldfarb (1945), Sarason (1959), Schlanger (1954), Zigler (1961) and Stevenson (1963). There are indications that limited verbal material available to the retarded because of limited environmental stimulation and exclusive association with peers may be underlying factors in blocking language development.

Other conditions have been mentioned as possible factors contributing to language deficits in the mentally retarded:

1. Auditory defects (Foale and Paterson, 1954; Kodman, Powers, Philip, and Weller, 1958; Siegenthaler and Krzywicki, 1959);
2. Handedness (Lewald, 1932);
3. Rh factor (Allen, 1948);
4. Phenylketonuria (Diedrich and Poser, 1960; Tischler, Gibson, McGeer and Nuttall, 1961).

Some research has also been directed toward the study of language functions for special types of retardation. Although representative studies are not specifically reviewed here, it appears that the focus has been mainly on higher level performance in the brain damaged and on speech characteristics such as articulation in the other groups, e.g., cerebral palsied and mongoloids. It would seem desirable to have more comprehensive studies on all groups if distinctions are to be made and programs of remediation are to be established.

CHAPTER II

EVALUATION OF LANGUAGE BEHAVIOR

Although the absence or restricted use of language is documented with the mentally retarded population (Spradlin, 1963; Spreen, 1965), there have been few investigations of specific language behavior with severely retarded children. In a recent review of the literature, Blount (1968) found that research on language abilities and efficacy of language programs are notably lacking on children with IQ's of 50 or less. Further, there are few procedures which are suitable for use in assessing the language competencies of these children.

Review of Assessment Instruments

The review of language evaluation procedures which follows reveals that investigators have tried to describe language behavior according to diverse practical and theoretical points. Language evaluation instruments available for current use will be described briefly.

Lerea (1958) presented research involving the construction of a set of clinical inventories which would yield quantitative data concerning the vocabulary and language structure of children between the ages of three and nine. His Michigan Picture Language Inventory (1958) tests specifically for both expression and comprehension. This test is divided into nine principal sections for testing the following classes of words: singular and plural nouns, personal pronouns, possessives, adjectives, demonstratives, articles, adverbs, prepositions, and verbs and auxiliaries.

The Northwestern Syntax Screening Test (Lee, 1969) was developed as a screening instrument for use with children three to eight years of age. It evaluates both receptive and expressive use of prepositions, pronouns, possessives, singular and plural verbs and nouns, demonstratives, negatives, yes/no questions, use of subject and object in active and passive declarative sentences, and use of direct and indirect objects in active declarative sentences.

Foster, Giddon and Stark (1969) constructed the Assessment of Children's Language Comprehension which tests understanding of 50 words in phrases which vary in length and construction. Its intent is to provide a description of the level at which a child is able to process lexical items such as core vocabulary and syntactic structures.

The Berry-Talbott Language Test (Berry, 1969) is based on Berko's technique and tests ability to use morphological rules, including formulation of plural and possessive (nouns), third person singular of verbs, progressive and past tenses, and comparative and superlative forms of adjectives.

The Utah Test of Language Development (Mecham, Jex and Jones, 1967) is an untimed measure designed for use with "aphasic and hyperactive brain injured individuals" which yields information concerning the general level of language functioning. Designed for use with children one to twelve years of age, it provides a language age equivalent based on 50 test items which draw heavily from the Vineland and Gesell scales.

The Houston Test for Language Development (Crabtree, 1958; 1963) is a teacher-observer team checklist. Included in the two parts of the test are subtests of self-identity, vocabulary, auditory judgments and melody patterns. This test also borrows items from the Vineland and Gesell scales.

Kirk, McCarthy and Kirk (1968) have developed the Illinois Test of Psycholinguistic Abilities (ITPA), Revised Edition, based on Osgood's (1957) mediated S-R model in an attempt to assess the differential language abilities of children two to ten years old. The test, following Osgood's theory, conceives of language behavior as encompassing three dimensions: channels of communication, psycholinguistic processes, and levels of psycholinguistic functioning. The twelve subtests were devised to measure decoding, association, and encoding processes at the representational (meaningful) or automatic-sequential levels of psycholinguistic functioning. Information about auditory receptive vocabulary and syntax, oral expressive vocabulary and syntax, visual perception, visual and auditory memory span, general information, and motor expressive abilities is provided.

The Parsons Language Sample (Spradlin, 1963), constructed on Skinner's (1957) analysis of verbal behavior, consists of 123 items divided into seven subtests. Three of the subtests (tact, echoic, and intraverbal) sample vocal or speech behavior. Three others (echoic gesture, comprehension, and intraverbal gesture) measure non-vocal communication. A seventh subtest (mand) measures either vocal or non-vocal behavior. The PLS was initially administered to 275 mentally retarded children between the ages of 7-11 and 15-8.

Lovell, Hersee and Preston (1968) have studied syntax. In order to examine his subjects' ability to recognize the syntactic similarity of words, Lovell developed an amended version of Brown and Berko's (1960) work. In this test, three stimulus situations are established where stimuli are blocks and toys, plasticene, and "dressing up" clothes. The speech of each child is recorded for a ninety minute period of time. All utterances are tape recorded and later transcribed. Judgments are made as to whether each utterance was egocentric or socialized according to Piaget's (1926) criteria.

Bangs (1961) describes a battery of psychometric tests designed to delineate the assets and liabilities of children with speech and/or language problems. A few well-known standardized test items selected from a variety of sources are used to explore the following: (1) language--ideation, comprehension, and usage; (2) memory/attention--visual and auditory; (3) visual-motor perceptual skills; and (4) social maturity.

A summary of the components said to be measured in these language tests, along with percentage of occurrence, is found in Table 1.

Of necessity, all tests included some form of auditory or visual reception and some form of motor expression. It appears significant that vocal and motor imitation, memory functions and kinesthetic reception receive considerably less attention in such tests, particularly in the light of research indicating their importance in the adequate usage of language (Schiefelbusch, 1963; Skinner, 1957; Osgood, 1963; Kirk and McCarthy, 1961; and Chalfant and Scheffelin, 1968).

It should be observed that most of these instruments measure or evaluate the language behavior of normally developing children. With the exception of the Parsons Language Sample, these tests were standardized or initially administered to and used with normal pre-school or elementary level children. Instruments which were constructed for the purpose of inventorying the language behavior of mentally retarded populations are absent. Current measures often do not provide a sample of the existing language in mentally retarded individuals. Rather, these tests provide scales of expected language based on existing language patterns in normal populations.

Table 1

Summary of Components Found in Eight Tests of Language Development*

Component	Percent
Reception	
Auditory	100
Visual	100
Kinesthetic	0
Expression	
Vocal	88
Motor	100
Imitation	
Vocal	50
Motor	13
Receptive Vocabulary (point to)	88
Sequential Memory	50
Body Concepts	50
Following Directions	50
Conceptual Information	25
Verbal Analogies	25
Closure (auditory-vocal-grammatic)	13
Syntax	
Prepositions	50
Singular (verb, noun)	50
Plural (verb, noun)	50
Pronouns	38
Possessives	38
Questions	38
Demonstratives	25
Adjectives (modifiers)	25
Negative	13
Active-Passive	13
Objective Case	13

* Tests included in this review were the Michigan Picture Language Inventory (Lerea, 1958); Northwestern Syntax Screening Test (Lee, 1969); Assessment of Children's Language Comprehension (Foster, 1969); Berry-Talbott Language Test

(Berry, 1969); Utah Test of Language Development (Mecham, 1967); Houston Test for Language Development (Crabtree, 1963); Illinois Test of Psycholinguistic Abilities (Kirk, McCarthy, & Kirk, 1968); and the Parsons Language Sample (Spradlin, 1963).

Theoretical Constructs as Bases for Evaluation

The value of a well-formulated theoretical construct lies in the specification of the variables and processes thought to be involved. It is this specification of variables and processes which can be useful in providing an organized approach toward describing and analyzing behavior. Where there is no underlying hierarchy of constructs or descriptive model which can be used to describe particular behaviors (such as language), attempts to measure the behaviors are likely to be random, unsystematic, and of limited value.

Of the tests reviewed above, only the PLS and ITPA are connected to such theoretical constructs. As a result, these two tests appear to sample a wide range of language behaviors whereas certain others do not. Some of the remaining tests sample language behavior in very specific areas (grammar, syntax, expressive vocabulary, complexity of response) and omit other areas (motor imitation, receptive skills).

Language Product

In the past, research on language development has been focused primarily on the production of language, i.e., the study of speech (McCarthy, 1954; Templin, 1957; Irwin, 1960; Wood, 1960). Examples of such measures of product are age of first word, vocabulary level, mean length of response, and grammatical construction. Controlled studies on related non-speech communication behavior such as imitation, use of gesture, and comprehension are largely absent, although they are very likely an important component in communication of mentally retarded children.

Normal Language Development

Study of language development with a low verbal functioning retarded population has been further complicated in that the major studies in the past were concerned with normal language development. These studies usually emphasized size of oral vocabulary in a developmental sequence (Thorndike, 1921; McCarthy, 1930; Little, McFarland and Williams, 1937; Burroughs, 1957).

Many of the more recent tests of language development have not shifted this emphasis to include the mild or severely language handicapped child. Rather than focusing on size of oral vocabularly, length of response, etc., these tests look at grammatical construction, development of syntax and other developmental sequences. These methods of sampling language behavior are still closely concerned with normal language development.

Normative and Descriptive Data

The drawbacks to using either normative or descriptive instruments in language evaluation, especially for purposes of determining present skills and indicating future directions, are many. Normative reference tests such as the Stanford-Binet Intelligence Scale (Form L-M, 1960), Illinois Test of Psycholinguistic Abilities (Kirk, McCarthy and Kirk, 1968) and the Peabody Picture Vocabulary Test (Dunn, 1959) give an indication of the child's knowledge of receptive language and expressive usage, but do not yield the information needed as to the specific concepts the child does or does not know, e.g., the number of object or action words, commands, and gestures to which the child can respond appropriately.

Some objections which can be raised with use of the descriptive data tests of developmental language such as the Houston Test for Language Development (Crabtree, 1963) and the Utah Test of Language Development (Mecham, Jex and Jones, 1967) include lack of definition as to the conditions for performance, and the subjectivity involved in using an adult's recall of the child's previous performance.

Direction-Giving in Standardized Testing

A child who has difficulty in using language may experience difficulty in following directions. In particular, severely retarded children have difficulty in following directions. This problem may be further compounded where elaborate procedures, involving much examiner instruction, make too many demands on the child. Therefore, some tests may not provide adequate qualitative information about the child's basic ability to process verbal information.

In summary, Perlberg (1967), in addressing the problem of evaluating language behavior, has made some timely observations about the development of evaluative instruments based on shortcomings of those presently in use:

1. Before measurement is attempted and instruction begins, all the objectives, terminal behaviors, and content of the proposed instructional program should be outlined in detail. All the instructional procedures, criteria for correct responses and criteria for learning should be clearly specified.

2. There is need for language sampling instruments which can be administered in a relatively brief period of time and yet which can provide an indication of the child's general level of receptive and expressive

functioning in the significant language areas.

3. There is need to develop a criterion reference testing procedure with specific pass-fail criterion. This testing procedure should be closely related to a general curriculum, content and instructional procedures.

4. The purpose of the sampling of language behavior with such an instrument should serve as a basis for modifying or changing the instructional procedures.

5. It may be possible to organize the above implications into a single procedural format for measuring language development.

Theoretical Bases for Describing Language

One purposeful way of selecting methods for studying language evaluation is to consider models of language that have been evolved. To this end, a review of the literature on the theoretical bases of language behavior and development was made. This review indicated that a good many theories had been formulated, usually attended by a characteristic model. A listing of the major terms incorporated in ten such models is found in Table 2. It appears that there is still considerable variability among theorists as to the description of language behavior and how it may be conceptualized. The debate appears to cut across the various theories whether they be behavioristic, linguistic, or mathematical and the types of model inferred, whether they be one, two or three stage. Whereas one theory as applied to a model is limited to observable behaviors and does not anticipate more complex behavior, another may seek to infer behavior at the representational or association level and thus cannot be reduced to operations.

From Table 2 it may be seen that the areas of greatest agreement

Table 2

Summary of Major Terms Found in Ten Models of Language Development*

Term		Percent
1.	Channels (Input-Output)	70
2.	Vocal Behavior (production of sound)	70
3.	Hierarchy of Arrangement (random to refined behavior)	50
4.	Motor Speech	40
5.	Tact Behavior	40
6.	Echoic Behavior	40
7.	Mother-Child Interaction and Reinforcement	40
8.	Use of Morphemes (meaning)	40
9.	Verbal Behavior (S's responses, stimulation, and reinforcement)	40
10.	Sensory Feedback; Cues	30
11.	Memory Store	30
12.	Source-Transmitter	30
13.	Mand Behavior	20
14.	Stimulus Recognition	20
15.	Evaluate	20
16.	System of Rules (expansion-transformation)	20
17.	Immediate Constituents	20
18.	Processes (automatic, sequential)	20
19.	Conceptual (pattern analysis)	20
20.	Processors (visual, auditory, kinesthetic)	10
21.	Speech Sound Mimicry	10
22.	Levels of Organization	10
23.	Context	10
24.	Comprehension (auditory, visual)	10
25.	Intraverbal Behavior	10

* Representative works of the following authors were reviewed: Mowrer, 1952; Shannon and Weaver, 1953; Osgood, 1957; Skinner, 1957; Carroll, 1959; Saporta, Blumenthal, Lackowski and Reiff, 1961; Morton, 1964; Bijou and Baer, 1965; Jones and Wepman, 1965; and Johnson, 1965.

across all theoretical formulations are channels for input and output of language information, the production of sound (vocal behavior), and hierarchies of random to refined language behaviors. Although there are doubtless overlaps in some of the terms used by various theorists, this tabulation does show the proliferation of terminology and hypothesized processes involved in describing language behavior.

A number of observations may be drawn from this analysis. The first is that for the most part these models of language were not evolved for purposes of evaluating language behavior. Secondly, greater interest has been demonstrated on the part of researchers and clinical specialists in the problems of sampling language and interpreting their samples in light of either empirical or theoretical considerations. Also, the diversity and contradictory nature of these theories has caused confusion among those who have been concerned with evaluation of language. This could well account for construction of many tests that have not been based on theory.

CHAPTER III

THE PROBLEM

A conclusion from the review of language evaluation instruments is that neither the antiquated methods such as frequency counts nor the more recent phrase structure grammars are adequate to approach the problem of language retardation. There needs to be collected a body of data that will be descriptive of the conditions under which the child best learns language. This type of information has been lacking in traditional language evaluation measures which have been concerned primarily with amount of product rather than process. There is a need for newer diagnostic tools more closely related to conditions of learning and instructional methods, the value of which should be of immediate relevance to the classroom situation of teaching language.

The problems involved in the study of language development and language behavior in severely retarded children are many and varied. A summary of these problems may be profitable.

1. There has been lack of consensus on a comprehensive or generally accepted theory of language (Sievers, 1955);

2. The severely retarded population has a high prevalence of deviant and non-adaptive language behavior (Bricker and Bricker, 1970a);

3. The slow rate of language learning by severely retarded children has been generalized into an assumption that they do not profit from language instruction; and

4. There is a lack of objective scales of measurement and adequate measuring instruments (Kirk, 1964).

The few existing tests of language for mentally retarded children have been concerned with sampling the product in language learning. Having sampled the product of language learning, one is better able to select language concepts and instructional objectives. Unfortunately, language samples do not necessarily tell the teacher the conditions under which the child learns best. They also do not give sufficient results regarding any one aspect of language functioning, such as imitative, receptive or expressive language skills.

Purpose

The purpose of this study was to develop an inventory which would measure language products of severely retarded children, ages six and one-half to ten.

CHAPTER IV

PROCEDURES

A number of steps were taken to develop a language inventory and to collect data on the language development of young severely retarded children. The following subproblems were treated:

1. Development of procedures, based on five of Gagné's (1965) eight types of learning, which would inventory the language repretoires of severely retarded children;

2. Construction of a table of specifications based upon the literature and recent research;

3. Establishment of a pool of items based upon existing tests, typical tasks, and teacher observations;

4. Establishment of preliminary content validity;

5. Conduction of a pilot testing program in order to select items with acceptable reliability and validity for inclusion in the final form of the inventory; and

6. Administration and analyses of the inventory in its final form to a sample population.

Selection of the Theoretical Construct

Gagné (1965) has described a hierarchy of types of learning. (Table 3) These formulations may have considerable potential for describing language learning. In this study, five of the eight types of learning defined in the hierarchy were used to describe the levels of language learning attained by severely retarded children. A language inventory based on these selected

Table 3

Types of Learning*

Type 1:	*Signal Learning*.--The individual learns to make a general, diffuse response to a signal. This is the classical conditioned response of Pavlov (1927).
Type 2:	*Stimulus-Response Learning*.--The learner acquires a precise response to a discriminated stimulus. What is learned is a connection (Thorndike, 1898) or a discriminated operant (Skinner, 1938), sometimes called an instrumental response (Kimble, 1961).
Type 3:	*Chaining*.--What is acquired is a chain of two or more stimulus-response connections. The conditions for such learning have been described by Skinner (1938) and others, notably Gilbert (1962).
Type 4:	*Verbal Association*.--Verbal association is the learning of chains that are verbal. Basically, the conditions resemble those for other (motor) chains. However, the presence of language in the human being makes this a special type because internal links may be selected from the individual's previously learned repertoire of language.
Type 5:	*Multiple Discrimination*.--The individual learns to make *n* different identifying responses to as many different stimuli, which may resemble each other in physical appearance to a greater or lesser degree. Although the learning of each stimulus-response connection is a simple Type 2 occurrence, the connections tend to interfere with each other's retention.
Type 6:	*Concept Learning*.--The learner acquires a capability of making a common response to a class of stimuli that may differ from each other widely in physical appearance. He is able to make a response that identifies an entire class of objects or events.
Type 7:	*Principle Learning*.--In simplest terms, a principle is a chain of two or more concepts. It functions to control behavior in the manner suggested by a verbalized rule of the form "If A, then B," where A and B are concepts. However, it must be carefully distinguished from the mere verbal sequence "If A, then B," which may also be learned as Type 4.
Type 8:	*Problem Solving*.--Problem solving is a kind of learning that requires the internal events usually called thinking. Two or more previously acquired principles are somehow combined to produce a new capability that can be shown to depend on a "higher-order" principle.

*From Gagné, R. M. *The Conditions of Learning*. New York: Holt, Rinehart & Winston, 1965, pp. 58-59.

types of learning was constructed to assess language behaviors.

The five types of learning which were selected for representation in the language inventory are stimulus-response, chaining, verbal association, multiple discrimination and concept learning. Signal learning, on the lower end of the hierarchy, was not included in the battery of subtests as it was considered a response of the autonomic nervous system. Both principle learning and problem solving, at the upper end of the hierarchy, were omitted because the types of language development that can be tested at these levels are represented in intelligence tests.

The eight subtests which compromise the language inventory are listed in Table 4. One subtest was constructed under each of the following learning types: stimulus-response, verbal association, multiple discrimination and concept development. Four subtests were constructed to represent chaining. The development of four subtests under chaining was necessary because different types of chaining were explored.

Table 4

Summary of Learning Types and Representative Subtests

Type of Learning	Subtest
Stimulus Response	1. Stimulus Response
Chaining	2. Motor Imitation
	3. Vocal Imitation
	4. Chaining Objects
	5. Chaining Actions
Verbal Association	6. Verbal Association
Multiple Discrimination	7. Multiple Discrimination
Concept	8. Concept Development

Specifications for the Study of Language

The language inventory reflects a body of specifications which were derived from the general literature and recent research in the areas of mental retardation, psycholinguistics, speech development and psychology. It also reflects some issues taken from Gagné's theoretical construct. Table 5 provides a summary of those elements used in existing language tests and in the present language inventory. Areas in which standardized tests are available are marked with an "X." Areas in which test coverage was limited are marked "Limited Usage."

Table 5

Summary of Language Related Activities in Evaluation of Language Development

Vocabulary		Imitation		Chaining	Motor Expression	Multiple Discrimination	Concepts
Receptive	Expressive	Vocal	Motor				
Included in Tests Previously Reviewed							
Limited Usage	x	x		Limited Usage	x	x	Limited Usage
Areas of Needed Exploration							
x		x	x	x	x	x	x
Included in Present Test (Language Inventory)							
x	x	x	x	x	x	x	x

A wide variety of items, representative of the specifications in Table 5, were included in the inventory. The areas of receptive vocabulary, chaining actions, and concept development were given particular attention.

Preliminary Selection of Test Items

Eight language tests currently in use were analyzed for major components in terms of types of items included and major areas of language behaviors represented. Similarly, ten curriculum guides for use in classes for young trainable children were reviewed for representative language tasks. A large pool of items was drawn up for inclusion in the preliminary form of the inventory. For each of the eight proposed subtests, the item pool contained two to three times the number of items expected to comprise the final form of the inventory.

A group of ten curriculum guides representing various geographic areas of the United States was chosen for intensive study. Each was reviewed for content related to (1) language teaching, (2) language tasks, (3) description of language behaviors and (4) vocabulary sections. A similar study was conducted with the eight language tests in order to identify major areas of language behavior tested and types of representative items.

Establishing Preliminary Content Validity

A preliminary content validity was established by submitting the items in the preliminary form of the inventory to a panel of teachers, supervisors and teacher trainers who have worked closely with this population of children.

The panel chosen to review items included in the inventory consisted of two experts in each of the areas listed above. All had direct experience with young severely retarded children. Comments and suggested additions and deletions from these professionals were used to modify the preliminary form of the language inventory.

Preliminary Subtest Construction and Administration

A preliminary form of the inventory, utilizing two to three times the expected number of items in the final form of each subtest, was given to a group of subjects at each of four age levels. Upon completion of this administration of the test the results were analyzed in order to determine acceptability for inclusion in the final form of the test.

The preliminary form of the inventory was given to approximately 20 retarded children (five from each of these CA groups: 6-6 to 6-11; 7-6 to 7-11; 8-6 to 8-11; and 9-6 to 9-11). After administration of the preliminary inventory difficulty levels were computed for all items. Items were chosen which had difficulty levels between 20 percent and 80 percent passing as observed across age levels. Each item selected correlated above .20 with the subtest of which it was a part.

Administration of the Language Inventory

The final form of the language inventory was administered to 160 subjects (40 at each of the four age levels). Ten children from each age level were retested for the purpose of obtaining test-retest reliability. Retests were administered within four to six weeks of the original test date. The results of this phase of testing are analyzed in a later section.

Definition of a Severely Retarded Child

A severely retarded child was operationally defined as one who obtains an intelligence test score between 35 and 55 on the 1961 Stanford-Binet Intelligence Scale, Form L-M, administered by the school district psychologist.

Selection of Subjects

The sample was drawn from children attending public school classes for the severely retarded approved by the State of Illinois Office of the Superintendent of Public Instruction. Location of schools and distribution of children are presented in Table 6. Children considered for selection had chronological ages between 78 and 119 months (6-6 to 6-11; 7-6 to 7-11; 8-6 to 8-11; 9-6 to 9-11 CA) and IQ's between 35 and 55. Each child selected on the above criteria was given an individual audiometric sweep check at the 25 dB level (ISO) at 500, 1000, 2000, 4000 and 6000 Hz. The hearing screening was conducted on a Beltone 9-D audiometer, administered by the author. A child was considered to have passed the screening test if he heard three or more of the frequencies in each ear. Children who met this audiological criteria and had no gross visual defects as identified by school vision tests were selected for testing.

The mean CA's and IQ's of the four age groups are presented in Table 7. The CA is in terms of months. In Table 8 the mean CA's and IQ's of the various age groups are divided into low (35-44) and high (45-55) IQ groups.

Description of Subtests

A brief description of each subtest is given below. Types of scoring, format and administration will be discussed. The complete inventory can be found in Appendix C.

Stimulus-Response

The first subtest in the language inventory was designed to accompany Gagné's second type of learning, stimulus-response.

A primary concern at this level of examination was to determine, in

Table 6

Location and Numbers of Subjects Used in Study

School and Location	Age Groups			
	6-6/6-11	7-6/7-11	8-6/8-11	9-6/9-11
Armstrong Center Mattoon, Illinois	2	1	-	2
Bush School Libertyville, Illinois	1	-	6	10
City School Unit #58 Waukegan, Illinois	1	2	2	2
Dobe Estate Libertyville, Illinois	6	8	1	-
Graham Elementary Jacksonville, Illinois	6	3	2	-
Hensley School Fisher, Illinois	-	3	1	1
Hope Wall School Aurora, Illinois	10	1	8	8
Lincoln Elementary Beardstown, Illinois	2	1	2	2
Marshall Elementary Marshall, Illinois	4	2	-	2
SPEED Center Park Forest, Illinois	3	5	10	7
Sibley Elementary Sibley, Illinois	1	1	-	-
Southside Elementary Effingham, Illinois	1	2	-	-
Sunnyside School Decatur, Illinois	1	3	2	5
Washington School Danville, Illinois	2	5	2	1
Welles School Watseka, Illinois	-	3	4	-
Total (N = 160)	40	40	40	40

Table 7

Characteristics of Subjects Used in the Study

Age Group	Number	Mean CA	Mean IQ
6-6/6-11	40	80.28	42.17
7-6/7-11	40	92.80	41.92
8-6/8-11	40	104.52	43.92
9-6/9-11	40	116.48	44.77

Table 8

Mean CA and IQ of Subjects When Bifurcated by IQ*

Age Group	Mean CA	Mean IQ
6-6/6-11		
High (N = 14)	80.28	49.64
Low (N = 26)	80.27	38.15
7-6/7-11		
High (N = 15)	92.53	48.00
Low (N = 25)	92.96	38.28
8-6/8-11		
High (N = 19)	104.37	49.89
Low (N = 21)	104.66	38.05
9-6/9-11		
High (N = 23)	116.26	48.47
Low (N = 17)	116.76	38.58

* High IQ Group (45-55)
Low IQ Group (35-44)

very general terms, an answer to the question, "How well does the child attend to familiar objects in his environment?" A variety of items were selected for inclusion, which are representative of objects common to home and school settings. Items include objects representing toys, clothing, grooming and food.

Traditional test formats, such as those scoring a response as right or wrong depending upon reaction to an object or objects or those requiring a verbal expression such as labels or descriptions, were not used in the presentation and scoring. The subtest consists of eleven items. In order to establish an academically meaningful analysis of the child's responses to these specific stimuli, a task analysis approach was used. In this format, an object is presented and a range of reactions, ranging from no response to appropriate terminal response, can be observed and recorded. For this subtest the range of responses is along a scale of zero to five and credit is cumulative for each item.

Motor Imitation

Motor Imitation was conceived here as one of four kinds of chaining operations. This is the first of four subtests representing the different aspects of chaining as a type of learning.

The question posed at this level of examination was, "To what extent can the child imitate a series of non-meaningful motor movements?" The subtest is composed of seventeen non-meaningful motor movements. Use of non-meaningful motor movements was adopted in an attempt to lessen the effects of experience.

In this subtest no vocal expression is required of the child. Items are presented by the examiner, who asks the child to "Do this" (imitate the action or actions presented). Items are presented in a simple to complex sequence, i.e., from imitation of from one movement up to a series of four movements). Scoring is on a right-wrong basis. One credit is given for exact imitation of an item; no credit is given if the item is not imitated exactly.

Vocal Imitation

The Vocal Imitation subtest is the second of four subtests representing chaining as a type of learning.

The question asked at this level of examination was, "How well can the child imitate a series of non-meaningful speech sounds of increasing complexity?"

This is the first subtest to require any vocal expression of the child. The twenty-two items are presented in the same manner as in the Motor Imitation subtest. The sequence follows a simple to complex pattern, i.e., consonant-vowel, consonant-vowel-consonant, two syllables. Scoring is also similar in that exact imitation is credited and incorrect imitation is not credited.

Chaining Objects

The Chaining Objects subtest is the third of four subtests representing chaining as a type of learning.

The information desired at this level of examination was, "How well can the child demonstrate receptive knowledge of various functional actions?" In this subtest, the child demonstrates his knowledge by the way he manipulates specific objects.

A series of seventeen objects, consisting of either household objects or clothing, are presented to the child in conjunction with the direction "Show me _____(drinking, tying, etc.)." The method of scoring follows the task analytic approach described in the Stimulus-Response subtest. Depending on the extent of his actions, which could range from no response to correct terminal response, a child may receive partial or full credit for a given item.

Chaining Actions

The Chaining Actions subtest is the last of four subtests representing chaining as a type of learning.

The information desired at this level of examination was the same as that for the Chaining Objects subtest. However, the receptive knowledge must be demonstrated without the use of specific objects.

In the administration of this subtest, the child is asked to demonstrate his understanding of fourteen different actions. The method of presentation ("Show me_____") and scoring is similar to Chaining Objects.

Verbal Association

The Verbal Association subtest was designed to represent verbal association as a type of learning.

The question asked at this level of examination was, "Can the child provide a label for something he sees?" Expressive language is required of the child in that he is expected to provide a name or label.

For this subtest a traditional test format was used. A series of thirty-one pictures (one picture per plate) is presented and the examiner asks "What is it?" or "What do you call this?" In the scoring procedure, one credit is given for an acceptable label and no credit is given for other responses.

Multiple Discrimination

The Multiple Discrimination subtest was designed to represent multiple discrimination as a type of learning.

The question asked at this level of examination was, "From a field of similar objects, can the child discriminate the critical object and point to it?" This is a task of receptive rather than expressive language. The emphasis is on evaluating receptive vocabulary without penalizing the child for lack of expressive language.

In the administration of this subtest, a series of twenty-seven picture plates (four pictures per plate) are presented. From a field of four similar objects, the child is asked, "Show me the _____." He must discriminate the correct (critical) item by pointing to it. A credit is given for each correct identification.

Concept Development

The Concept Development subtest was designed to represent concept formation as a type of learning.

The question asked at this level of examination was, "Can the child apply a classification or group label to an object in a field of dissimilar and unrelated objects?" This is also a task of receptive rather than expressive language.

The administration and scoring of this series of twenty-three items follows that of the Multiple Discrimination subtest.

Statistical Analysis

To test for significant differences in performance related to the variables of age, IQ and sex on each subtest, an analysis of variance was performed. F ratios were computed for each of the sources of variance.

Item statistics for each subtest were computed. Analyses on the five subtests utilizing a right-wrong scoring system were carried out by using a standard MERMAC test analysis package programmed for the IBM 360-20 computer. Analyses included mean, median, standard deviation, standard error of measurement, frequency distribution, ranking by fifths, proportion passing, Kuder Richardson Formula 20 reliability coefficients, and point biserial correlations. For the three subtests having items utilizing a cumulative credit scoring system, means, standard deviations, item-subtest correlations and coefficient alpha are presented.

CHAPTER V

ANALYSIS OF SUBTEST RELIABILITIES ON THE LANGUAGE INVENTORY

One of the first requirements of a test is its internal consistency. Any test can have a number of different coefficients of reliability, depending, of course, on the sources of measurement error. Reliability is held to be a necessary condition for establishing validity, and the reporting of reliability coefficients shows one index of the effectiveness of an instrument.

For the purpose of establishing preliminary reliability information for the various subtests, two types of reliability data are presented. Coefficient alpha and Kuder Richardson-20 are used to compute reliability coefficients for item interrelationships on the subtests. For the three subtests utilizing a cumulative credit scoring system, coefficient alpha was computed. The Kuder Richardson-20 was used to compute correlation coefficients for the five subtests having a dichotomous scoring system. The results are reported in Table 9. A test-retest measure for determining reliability coefficients was also undertaken. Results are reported in Table 10.

On the question of acceptable standards of reliability, Nunnally (1967) has stated that in the early stages of research on predictor tests or hypothesized measures of a construct, reliabilities of .60 or .50 will suffice. Corrections for attenuation using the Spearman-Brown prophecy formula, showing how much the correlations will increase when reliabilities of measures are increased, are given for the five subtests utilizing the MERMAC test analysis program. This data can be found in Appendix D.

Table 9

Reliability Coefficients and Related Data for Subtests of the Language Inventory

Subtest	Maximum Possible Score	Mean	Standard Deviation	KR-20	Coefficient Alpha
Stimulus Response	55	45.36	8.37	-	.88
Motor Imitation	17	10.55	3.06	.77	-
Vocal Imitation	22	11.94	5.76	.89	-
Chaining Objects	73	48.99	14.10	-	.79
Chaining Actions	26	17.30	5.45	-	.81
Verbal Association	31	16.93	7.42	.91	-
Multiple Discrimination	27	17.01	5.51	.85	-
Concept Development	23	12.09	4.80	.83	-

Table 10

Test-Retest Correlations for the Language Inventory

Subtest	Standard Deviation	Correlation
Stimulus Response	7.88	.34
Motor Imitation	3.48	.77
Vocal Imitation	6.02	.90
Chaining Objects	16.73	.77
Chaining Actions	5.88	.90
Verbal Association	8.29	.90
Multiple Discrimination	6.28	.94
Concept Development	5.29	.86

Analysis of Reliabilities by Subtest and Age

In this section, two estimates of reliability are discussed. Data for item interrelationships are given as coefficient alpha or KR-21 reliability coefficients, and test-retest reliability estimates are presented. Also, reliability coefficients for each age group on the subtests are considered.

Stimulus-Response

For the Stimulus-Response subtest, the item consistency correlation of .88 was relatively high. However, the test-retest correlation was only .34. This low correlation was consistent with the findings of the validity study. Performance did not increase with age, although all subjects tended to score high. Reliability coefficients, when computed for age groups, appeared to be high. Table 11 shows the range to be from .86 at the 7-6 year level to .96 at the 6-6 year level.

Table 11

Reliability Coefficients and Related Data
by Age for Stimulus-Response Subtest

Age	N	Mean	Standard Deviation	Coefficient Alpha
6-6/6-11	40	42.28	10.76	.96
7-6/7-11	40	56.85	6.40	.86
8-6/8-11	40	47.43	7.27	.87
9-6-9/11	40	44.90	10.65	.92

Motor Imitation

The Motor Imitation subtest has a reliability coefficient of .77. Although this was the lowest estimate of reliability received for any of the subtests, it is well above Nunnally's criteria for acceptance as a satisfactory level of reliability. Test-retest correlation was .77. Reliability coefficients across age are somewhat low. As seen in Table 12, the range was from .05 for the 8-6 age group to .72 for the 9-6 age group.

Table 12

Reliability Coefficients and Related Data
by Age for Motor Imitation Subtest

Age	N	Mean	Standard Deviation	KR-21
6-6/6-11	40	8.77	3.18	.62
7-6/7-11	40	10.60	2.82	.53
8-6/8-11	40	11.20	2.00	.05
9-6/9-11	40	11.63	3.37	.72

Vocal Imitation

Vocal Imitation has a reliability coefficient of .89 and a test-retest correlation of .90. Analysis of reliability estimates according to age yielded similarly high coefficients. Table 13 shows the range to be from .83 at 8-6 to .88 at 9-6. The questions raised in the validity study are not reflected in the analysis of reliability other than the 8-6 group obtaining a slightly smaller reliability coefficient.

Chaining Objects

A reliability coefficient of .79 was obtained for the Chaining Objects subtest. The test-retest correlation was .77. Reliability estimates when computed for age, were all above .75 with the highest correlation being

.86 for the 9-6 age group (Table 14).

Table 13

Reliability Coefficients and Related Data
by Age for Vocal Imitation Subtest

Age	N	Mean	Standard Deviation	KR-21
6-6/6-11	40	8.17	5.43	.87
7-6/7-11	40	12.80	5.26	.85
8-6/8-11	40	12.50	5.09	.83
9-6/9-11	40	14.30	5.55	.88

Table 14

Reliability Coefficients and Related Data
by Age for Chaining Objects Subtest

Age	N	Mean	Standard Deviation	Coefficient Alpha
6-6/6-11	40	39.05	13.61	.79
7-6/7-11	40	49.23	12.05	.78
8-6/8-11	40	54.08	11.16	.75
9-6/9-11	40	53.63	14.33	.86

Chaining Actions

On the Chaining Actions subtest a reliability estimate of .81 was computed. The test-retest correlation was .90. Reliability estimates were somewhat lower when analyzed according to age. A coefficient of .59 was reported for the 8-6 group and .87 for the 9-6 group. These two coefficients represented the range across the four age groups (Table 15).

Table 15

Reliability Coefficients and Related Data
by Age for Chaining Actions Subtest

Age	N	Mean	Standard Deviation	Coefficient Alpha
6-6/6-11	40	13.45	5.64	.76
7-6/7-11	40	16.50	4.58	.69
8-6/8-11	40	19.80	3.29	.59
9-6/9-11	40	19.45	5.50	.87

Verbal Association

For the Verbal Association subtest, a reliability coefficient of .91 was obtained. The test-retest correlation was .90. As reported in Table 16, the range between coefficients was from .79 for the 8-6 group to .91 for the 9-6 group.

Table 16

Reliability Coefficients and Related Data
by Age for Verbal Association

Age	N	Mean	Standard Deviation	KR-21
6-6/6-11	40	11.35	5.81	.81
7-6/7-11	40	14.72	6.05	.82
8-6/8-11	40	19.57	5.54	.79
9-6/9-11	40	22.07	7.22	.91

Multiple Discrimination

On this subtest the reliability coefficient was .85. A test-retest correlation of .94 was obtained. The reliabilities for the four ages were moderately high as shown in Table 17. The range was from .67 at 6-6 to .82 at 9-6.

Table 17

Reliability Coefficients and Related Data
by Age for Multiple Discrimination Subtest

Age	N	Mean	Standard Deviation	KR-21
6-6/6-11	40	12.50	4.34	.67
7-6/7-11	40	15.05	4.44	.69
8-6/8-11	40	19.72	4.01	.70
9-6/9-11	40	20.77	4.74	.82

Concept Development

For the Concept Development subtest, a reliability coefficient of .83 was obtained. A test-retest correlation of .86 was reported. The range was from .55 for the 8-6 group to .69 for the 6-6 and 7-6 groups (Table 18).

Table 18

Reliability Coefficients and Related Data
by Age for Concept Development Subtest

Age	N	Mean	Standard Deviation	KR-21
6-6/6-11	40	8.50	3.99	.69
7-6/7-11	40	9.90	4.09	.69
8-6/8-11	40	14.30	3.38	.55
9-6/9-11	40	15.65	3.70	.66

Summary

Item consistency reliability coefficients for subtests of the language inventory ranged from .61 to .89. When reliability estimates for item consistency were examined by age, seven of the subtests had correlation coefficients which ranged between .62 and .96. For the Motor Imitation subtest the reliability coefficients were lower, ranging from .05 to .72. Reliability coefficients were highest for the following subtests: Stimulus-Response (.86 to .96); Vocal Imitation (.83 to .88); and Verbal Association (.79 to .91).

Test-retest correlations for the language inventory were between .77 and .94, except for the Stimulus-Response subtest which had a correlation of .34. There appeared to be a slight positive, random variance associated with the test-retest reliability estimates.

CHAPTER VI

ANALYSIS OF AGE AND IQ DIFFERENCES IN PERFORMANCE ON THE LANGUAGE INVENTORY

In this chapter, the steps which were taken to establish content validity will be discussed. This type of validity depends primarily on the adequacy with which a specified domain of content is sampled. The language inventory could not be validated in terms of predictive validity because the purpose of the inventory was not to predict something else but to directly measure performance on a set of language tasks. Validity could not be determined by correlating the inventory with a criterion because the inventory itself was the criterion of performance.

Validity can be aided by the plan and procedures of construction. Standards for establishing content validity were followed. Content validity can be estimated by evaluating the relevance of test items. Each item should be a sampling of the knowledge or performance which the test purports to measure. Collectively, the items should constitute a representative sample of the variable to be tested. In order for the items to sample the behavior domain to be measured, a detailed outline of the questions and problems that will be included is necessary. Validity of content also should be based upon careful analyses by several specialists of instructional objectives and the actual subject matter studied.

The validating process should include statistical analyses for the purpose of determining the percent that answers each item correctly and determining increase in mean scores across units such as time or age.

In Chapter IV, the procedures which were used to establish preliminary content validity were described. A table of specifications was constructed for the purpose of identifying representative language behaviors. A preliminary language inventory was also constructed, reviewed and revised by six specialists, and then administered to a small group of children. Following these procedures, further steps were taken in order to establish content validity for the final form of the inventory. After statistical analyses were performed and difficulty levels and item subtest correlations were known, a revised form of the language inventory was constructed. The revised form was then submitted to the specialists for their review. This review was considered necessary in order to (1) secure a representative sampling of language behaviors and (2) provide representation for all areas listed in the table of specifications. The final form thus contained items representing the areas of language behavior identified in the table of specifications as well as items representative of the theoretical hierarchy.

In the following sections of this chapter, age and IQ differences on the eight subtests of the language inventory will be considered. The intent of this language inventory has been to investigate the development of language products in a group of young retarded children. According to testing theory, it is expected that performance will increase with age and IQ. Age progression of test scores, in particular, may be taken as evidence for the validity of a test (Irwin, 1960). A preliminary validation study of the subtests was undertaken by analyzing age and IQ differences in the data. This was done by analysis of variance.

Sex differences were not originally proposed as a major variable for analysis. However, as these data were available, sex was included as a variable in the analysis of variance. Tables containing F ratios and probability values for all variables (age, IQ and sex) and their interactions may be found in Appendix A.

Analysis of Age and IQ Differences on Subtest Performance

This section will consider the significance of differences between means on each subtest. Mean scores of subtests for combined IQ groups are presented in Table 19. Mean scores for the high and low IQ groups are presented in Table 20.

Table 19

Mean Scores of Subtests for Combined IQ Groups

Age Group Number	6-6/ 6-11 40	7-6/ 7-11 40	8-6/ 8-11 40	9-6/ 9-11 40	Maximum Possible Score
Subtest	Mean	Mean	Mean	Mean	
Stimulus Response	43.96	46.11	47.25	44.03	55
Motor Imitation	9.07	10.68	11.31	11.71	17
Vocal Imitation	8.62	13.31	12.71	14.04	22
Chaining Objects	40.09	50.77	54.23	52.42	73
Chaining Actions	14.24	17.04	19.82	19.15	26
Verbal Association	12.09	15.28	19.74	21.65	31
Multiple Discrimination	12.66	15.39	19.72	20.61	27
Concept Development	8.49	10.25	14.36	15.28	23

Table 20

Mean Scores of Subtests: High and Low IQ Groups

Age Group		6-6/ 6-11	7-6/ 7-11	8-6/ 8-11	9-6/ 9-11	Maximum Possible
Number per Group:	High IQ	14	15	19	23	
	Low IQ	26	25	21	17	
Subtest						
Stimulus Response						
High IQ		45.78	48.21	49.03	48.59	55
Low IQ		42.15	44.01	45.47	39.46	
Motor Imitation						
High IQ		10.10	11.63	11.96	12.05	17
Low IQ		8.04	9.73	10.66	11.38	
Vocal Imitation						
High IQ		9.43	14.51	12.28	16.94	22
Low IQ		7.81	12.11	13.14	11.14	
Chaining Objects						
High IQ		44.88	55.82	58.66	58.51	73
Low IQ		35.31	45.71	49.78	46.33	
Chaining Actions						
High IQ		16.25	18.12	21.34	21.36	26
Low IQ		12.23	15.96	18.29	16.93	
Verbal Association						
High IQ		14.43	16.33	22.11	25.27	31
Low IQ		9.77	14.24	17.36	18.03	
Multiple Discrimination						
High IQ		14.18	16.86	21.73	22.93	27
Low IQ		11.15	13.92	17.71	18.28	
Concept Development						
High IQ		9.18	11.54	16.19	17.53	23
Low IQ		7.81	8.94	12.52	13.03	

For each subtest, the following factors will be discussed: (1) analysis of variance data with reporting of F ratios and probability values; (2) evidence for linear growth with age; (3) evidence for a linear function of IQ (subjects with higher IQ's scoring higher than those with low IQ's); and (4) an indication of basal and ceiling levels of mean scores.

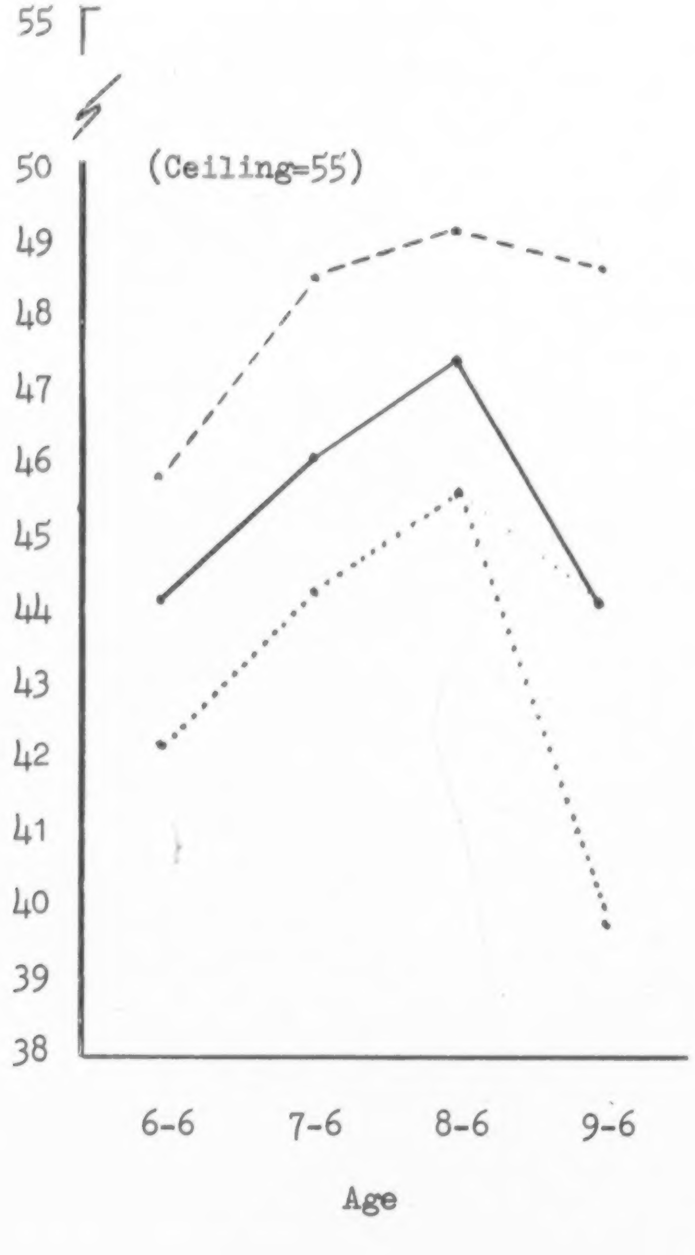
Stimulus-Response

For the Stimulus-Response subtest, IQ as a source of variation was significant with F (df = 1,158) equal to 14.38 and probability (p) of chance occurrence less than .001. Age, with F (df = 1,158) = 1.43, $p > .24$, and the age by IQ interaction with F (df = 1,158) = .98, $p > .40$, were not significant. In Figure 1, the differences between performance of the high and low IQ groups may be seen readily. There is evidence of some linear growth for the 6-6, 7-6 and 8-6 half year levels on the combined high and low IQ groups. However, the trend was downward for the 9-6 age group. For example, the 9-6 low IQ group did poorer than the 6-6 low IQ group. The range of mean scores was rather limited as the lowest obtained mean score was 39.46 and the highest was 49.03. This narrow range of scores, contained in the upper scoring range indicates that the items were too easy and were not discriminatory, especially at the 9-6 age level.

Throughout the final phase of testing, older subjects were observed to be more reticent about picking up the objects and manipulating them. As their verbal descriptions and discussion of the test items were not the critical object of scoring, this group may have been penalized. Possibly a motor response or set of responses to an object is not the dominant mode of expression for older groups of children. The type of items employed in this subtest may have more utility for describing the reactions of younger children.

Figure 1

Curve of Mean Scores on Stimulus-Response Subtest

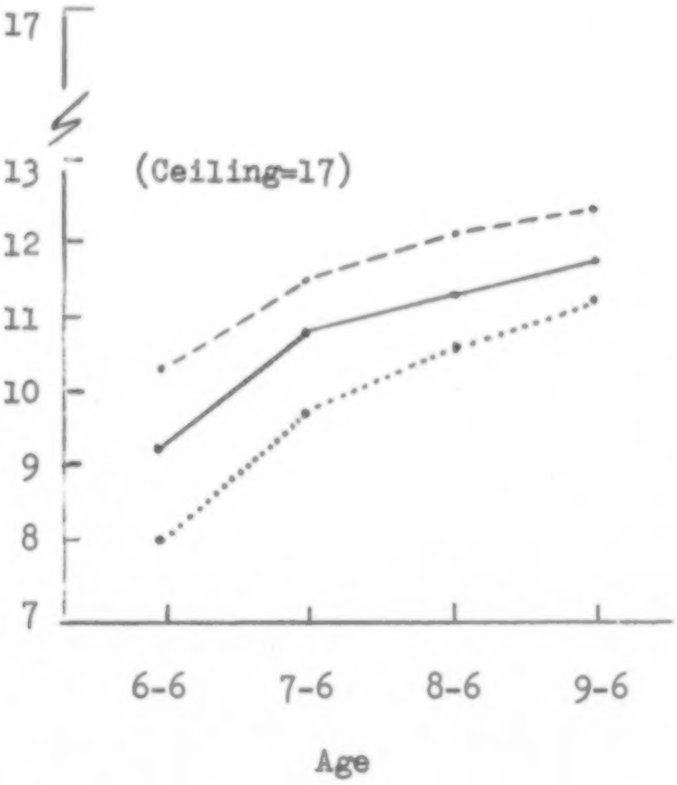


Motor Imitation

In this subtest, both age, with F (df = 1,158) = 6.03, $p < .001$, and IQ, with F (df = 1,158) = 9.79, $p < .002$, were significant sources of variance. The age by IQ interaction, with F (df = 1,158) = .92, $p > .72$, was not significant. The linear function of age and high and low IQ groups may be seen in Figure 2. Discrimination does not appear to be as sharp at the higher age levels (8-6 and 9-6) as at the lower age levels. The range of mean scores was from 8.04 at the lower IQ level to 12.05 at the higher IQ level. It does not appear that this subtest was too easy nor too difficult.

Figure 2

Curve of Mean Scores on Motor Imitation Subtest

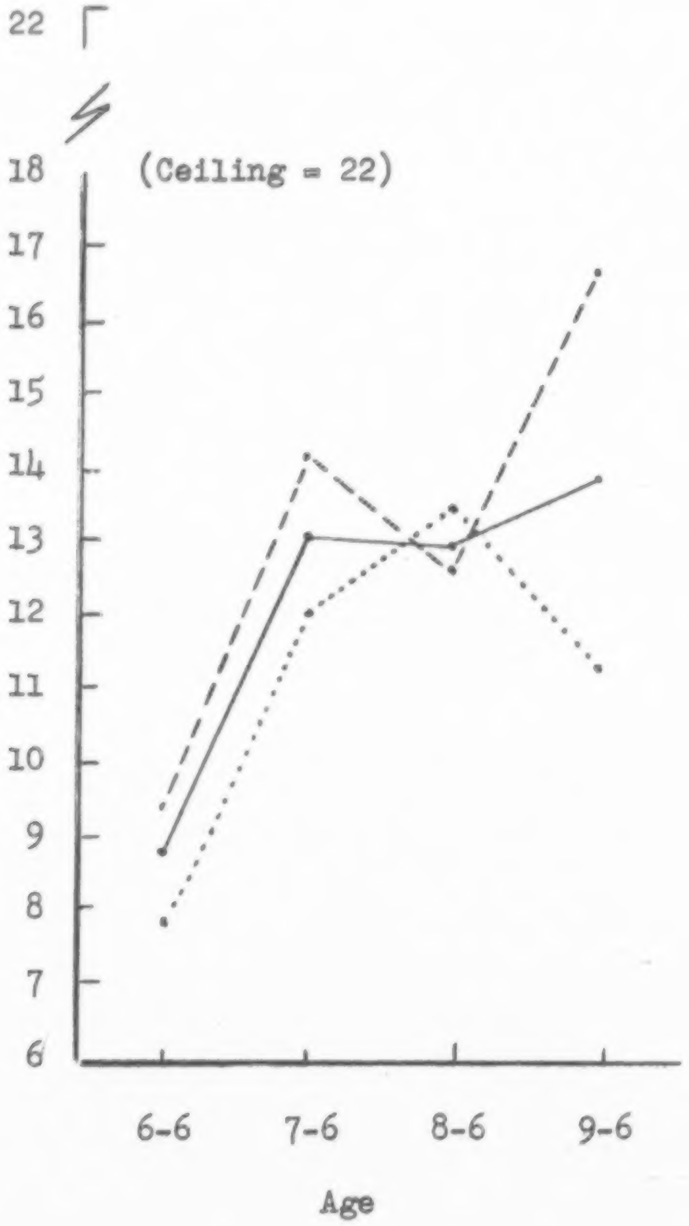


Vocal Imitation

For the Vocal Imitation subtest, age, with F (df = 1,158) = 8.18, $p < .001$, and IQ, with F (df = 1,158) = 6.91, $p < .010$, were found significant as sources of variance. The age by IQ interaction, with F (df = 1,158) = 2.63, $p > .053$, approached significance at an alpha level of .05. The mean scores of Vocal Imitation show a linear relationship with age except for the 8-6 age group as seen in Figure 3. This reversal, where the mean score for 8-6 was lower than the mean score for the 7-6 group, was true for the combined and high IQ groups. The subtest appears to be more discriminatory between the 6-6 and 7-6 and the 8-6 and 9-6 groups than between the middle age group of 7-6 to 8-6. Although the overall mean range of scores was from 7.81 to 14.51, a larger number of items may be needed to make the subtest more discriminatory across age levels. In further development, the interaction of age and IQ should be observed in its relationship with larger numbers of items and subjects taking the test.

Figure 3

Curve of Mean Scores on Vocal Imitation Subtest

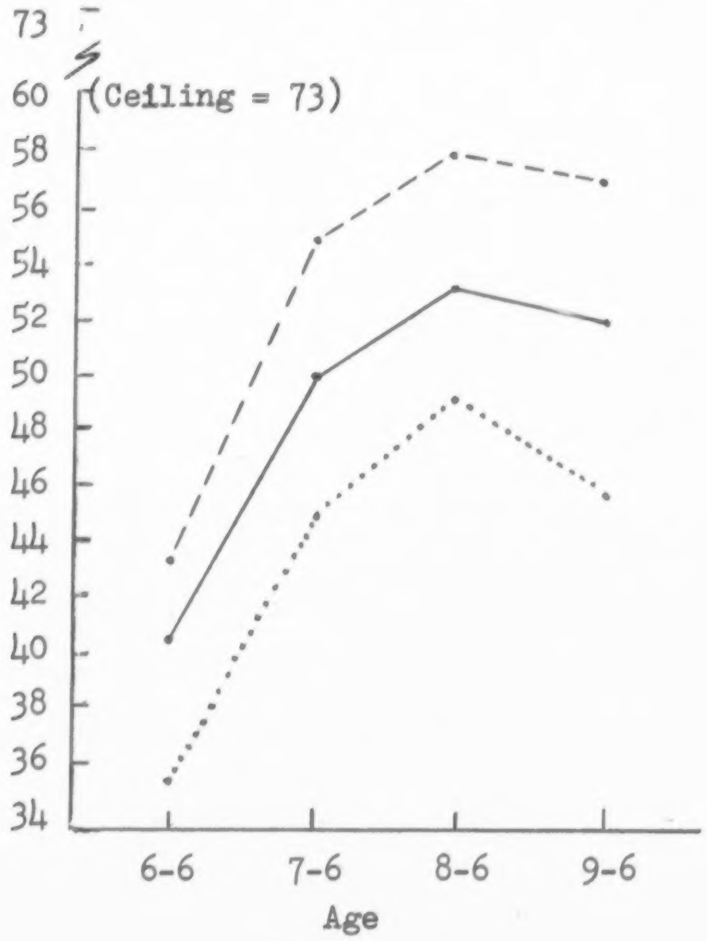


Chaining Objects

On the Chaining Objects subtest, the age variable, F (df = 1,158) = 9.63, $p < .001$, and the IQ variable, F (df = 1,158) = 24.77, $p < .001$, were significant. Age by IQ, F (df = 1,158) = .12, $p > .947$, was not significant. Figure 4 shows that the subtest discriminated rather well between the ages of 6-6, 7-6 and 8-6. For the combined, high and low IQ groups there was a slight drop in mean scores at the 9-6 level. This is the same type of downward trend noted in the Stimulus-Response subtest. The range of mean scores, including all IQ groups, was from 35.31 to 58.66. Although no group approached the ceiling of 73, the test might demonstrate a more linear relationship with age at the 9-6 level if more difficult items were included in the test.

Figure 4

Curve of Mean Scores on Chaining Objects Subtest

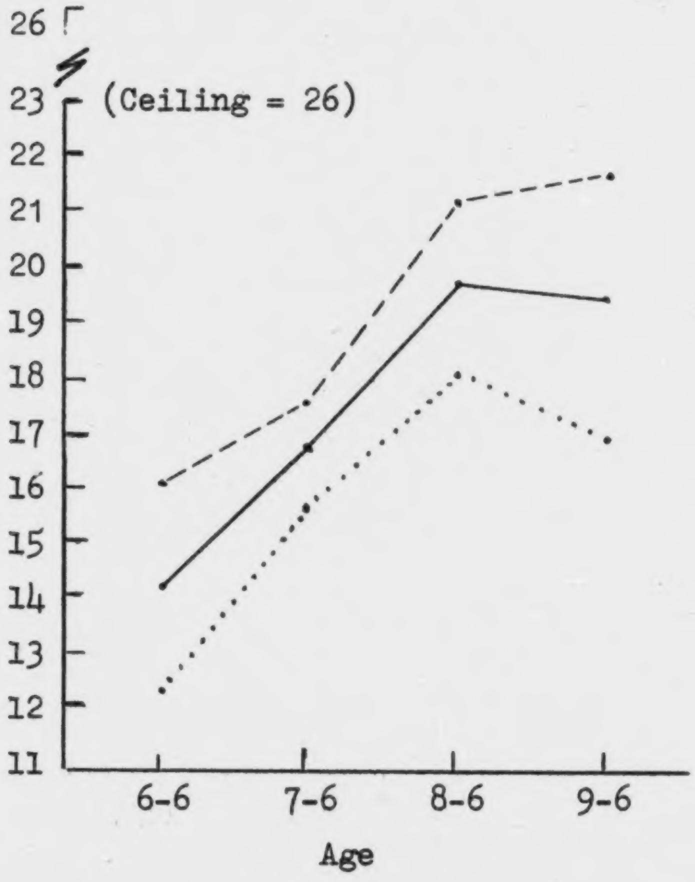


Chaining Actions

On this subtest, both age with F (df = 1,158) = 10.46, $p < .001$, and IQ with F (df = 1,158) = 19.30, $p < .001$, were significant. The interaction of age and IQ with F (df = 1,158) = .42, $p > .73$, was not dignificant. The same type of curve for the Chaining Actions subtest may be seen in Figure 5 as noted in Figure 4 for the Chaining Objects subtest. Mean scores tended to increase for the 6-6, 7-6 and 8-6 age groups with a slight drop for the 9-6 group. This was true for the combined and low IQ groups. For the high IQ group, the mean score for the 9-6 group was slightly above that of the 8-6 group, making the curve for this group show linear growth across all age groups. The range of mean scores across all IQ groups was from 12.23 to 21.34. There is evidence that, with the higher IQ group in particular, more items with higher difficulty levels are needed for this subtest.

Figure 5

Curve of Mean Scores on Chaining Actions Subtest

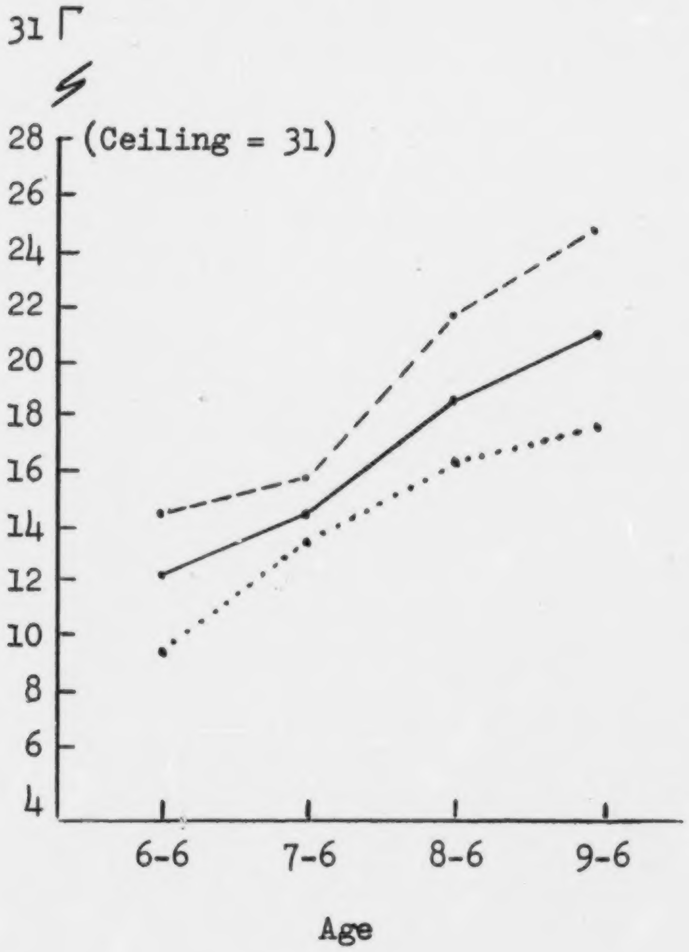


Verbal Association

For the Verbal Association subtest, both age variance with F (df = 1,158) = 20.23, p < .001, and IQ with F (df = 1,158) = 23.83, p < .001, were significant. The age by IQ interaction with F (df = 1,158) = 1.20, p > .312, was not significant. The mean scores of age on Verbal Association show a linear relationship as seen in Figure 6. The same linear increase was observed for the combined, high and low IQ groups. The range of mean scores for combined IQ groups was from 9.77 to 25.27.

Figure 6

Curve of Mean Scores on Verbal Association Subtest



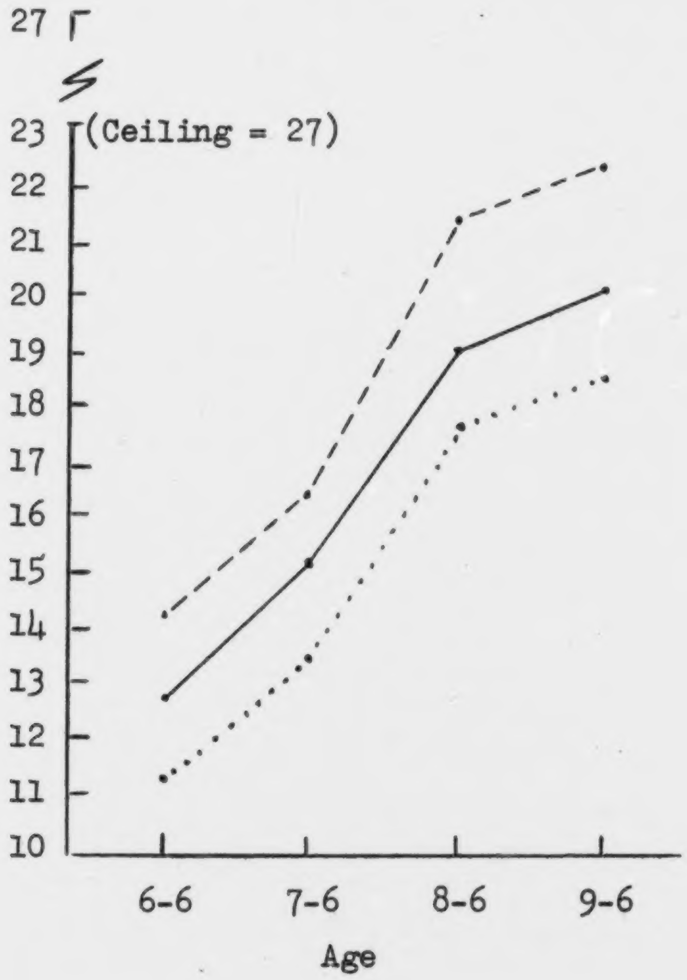
Multiple Discrimination

For this subtest, the age variable with F (df = 1,158) = 30.63,

$p < .001$, and the IQ variable with F (df = 1,158) = 29.44, $p < .001$, were also highly significant as sources of variance. The age by IQ interaction with F (df = 1,158) = .37, $p > .31$, was not significant. The mean scores in Figure 7 show a linear function with age for combined, high and low IQ groups. The range of mean scores was from 11.15 to 22.93. Although the ceiling was not reached by any age group, more items may be necessary to differentiate between the 8-6 and 9-6 age groups.

Figure 7

Curve of Mean Scores on Multiple Discrimination Subtest

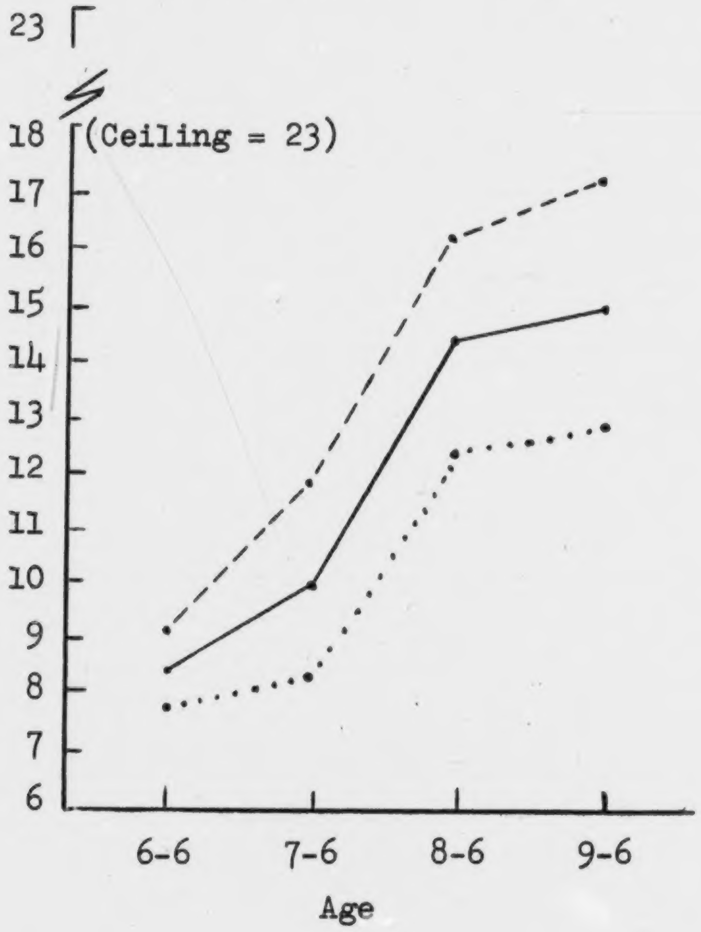


Concept Development

On the Concept Development subtest, both age, F (df = 1,158) = 29.90, $p < .001$, and IQ, F (df = 1,158) = 26.09, $p < .001$, were significant sources of variance. The interaction of age and IQ with F (df = 1,158) = 1.31, p > 2.75, was not significant. In Figure 8, the mean scores of Concept Development show a linear relationship with age and IQ. The range of mean scores was from 7.81 to 17.53. This subtest does not appear to be too difficult nor too easy.

Figure 8

Curve of Mean Scores on Concept Development Subtest



Summary

In terms of statistically significant differences, IQ was significant as a source of variance for all subtests. Age, with exception of the Stimulus-Response subtest, was significant on all subtests. The interaction of age and IQ was not significant at either .05 or .01 alpha levels for any of the subtests, although the .05 level of significance was approached on the Verbal Association subtest. Mean scores for age and IQ were plotted and discussed in terms of linear growth for age and IQ. Indications of basal and ceiling mean scores were also discussed. Mean scores demonstrated a linear progression with age for the Verbal Association, Multiple Discrimination and Concept Development subtests. The trend of mean scores was generally upward for the 6-6, 7-6, and 8-6 age groups. For the 9-6 group, there was a reduced increase of mean scores on Motor Imitation and Vocal Imitation, and little increase or a slight downward trend on the Stimulus-Response, Chaining Objects and Chaining Actions subtests.

CHAPTER VII

ANALYSIS OF INTERCORRELATIONS AMONG SUBTESTS

A study of the intercorrelations of the subtests was conducted to determine if the tests were measuring the same or different functions. In this section two relationships among the subtests will be discussed.

Data are presented on the correlation of CA with scores on the language inventory and intercorrelations among subtests in Table 21. Correlations, with age held constant or partialled out, are given in Table 22.

Correlation of CA with Scores on the Language Inventory

From Table 21 a wide range of correlations between subtests and age can be seen. The subtests correlated with age from .06 on Stimulus Response to .58 on Concept Development. The subtests correlating highest with age were Chaining Actions, .42; Verbal Association, .56; Multiple Discrimination, .59; and Concept Development, .58. A noticeable feature of the age-subtest correlation is the steady upward trend in correlation with age across the present hierarchy of subtests. Although the correlations with age were moderately high for approximately half of the subtests, correlation with the Stimulus Response subtest at .06 was extremely low. The low reliability and poor validity of this subtest has been discussed in previous sections.

Intercorrelations Among Subtests with Age Held Constant

In order to determine the relationship among the subtests without the influence of the age factor, age was controlled by partial correlation.

Table 21

Correlation of Chronological Age with Scores on the Language Inventory and Intercorrelations Among Subtests--Total Group

	Stimulus Response	Motor Imitation	Vocal Imitation	Chaining Objects	Chaining Actions	Verbal Association	Multiple Discrim.	Concept Development
CA	.06	.32	.34	.37	.42	.56	.59	.58
Stimulus Response		.09	.08	.13	.23	.01	.09	.08
Motor Imitation			.35	.40	.43	.39	.50	.42
Vocal Imitation				.47	.55	.56	.38	.39
Chaining Objects					.69	.51	.66	.64
Chaining Actions						.47	.56	.56
Verbal Association							.72	.65
Multiple Discrimination								.83

Table 22

Correlations Among Subtests with Age Partialled Out--Total Group

	Motor Imitation	Vocal Imitation	Chaining Objects	Chaining Actions	Verbal Association	Multiple Discrim.	Concept Development
Stimulus Response	.08	.06	.12	.22	-.02	.07	.05
Motor Imitation		.28	.32	.34	.27	.41	.30
Vocal Imitation			.39	.47	.47	.22	.24
Chaining Objects				.64	.39	.59	.56
Chaining Actions					.31	.43	.41
Verbal Association						.58	.48
Multiple Discrimination							.74

The information gained from these correlations will be related to the various types of learning hypothesized to be involved in the subtests.

Stimulus Response

As seen in Table 22, Stimulus-Response did not correlate very highly with any other subtest when the age factor was controlled. Its highest correlation was with Chaining Actions (.22) which involved a similar, although more structured task analytic format. The lowest correlations was with Verbal Association (-.02). Verbal Association and Stimulus Response have no structural similarities and apparently no conceptual similarity. Expressive language and a highly structured test situation are required in the Verbal Association subtest, whereas neither are involved in Stimulus-Response.

Motor Imitation

The Motor Imitation subtest (Table 22) correlated most highly with Multiple Discrimination when the age variable was removed. This subtest also correlated from .30 to .34 with Concept Development, Chaining Objects and Chaining Actions. Two of these subtests (Multiple Discrimination and Concept Development) represent two theoretically different learning types and are not similar in construction to the Motor Imitation subtest. Chaining Objects and Chaining Actions represent the chaining learning type, as does Motor Imitation.

Chaining Objects

As seen in Table 22, Chaining Objects correlated highly with Chaining Actions (.64). These two subtests are similar in composition and were constructed to represent the chaining type of learning. Slightly lower correlations were found with Multiple Discrimination (.59) and Concept Development (.56). The other correlations involving Chaining Objects ranged from .12 to .39.

Chaining Actions

The Chaining Actions subtest (Table 22) correlated most highly with the Chaining Objects subtest, as noted above. This subtest also correlated from .41 to .47 with three other subtests. It had a correlation of .47 with Vocal Imitation, which involves the same type of learning. The partial correlation coefficients of this subtest with the remaining subtests varied from .22 to .34.

Verbal Association

The highest correlation between Verbal Association and any other subtest in Table 22 was .58 with Multiple Discrimination. Although these two tests were not constructed to measure the same type of learning, they share a common element in the use of pictures as subtest items. Slightly lower correlations are reported with Concept Development (.48) and Vocal Imitation (.47). The other correlations involving Verbal Association ranged from 0.02 to .39.

Multiple Discrimination

Multiple Discrimination correlated most highly with Concept Development (.74). In Table 22 other fairly high correlations are reported with Verbal Association (.58), Chaining Actions (.43), Chaining Objects (.59) and Motor Imitation (.41). Lower partial correlations are given with Vocal

Imitation (.22) and Stimulus Response (.07).

Concept Development

The Concept Development subtest correlated from .41 to .74 with three different types of learning representing four subtests. Lower correlations ranging from .05 to .30 are reported for three other subtests. Subtests representing stimulus response learning and the first two subtests of chain learning correlated much lower with Concept Development than did subtests representing verbal association, multiple discrimination and concept learning.

Summary

The following conclusions may be drawn from the partial correlations among the subtests:

1. The subtests follow a theoretical hierarchy in which five different types of learning are represented. Each is more complex than the preceding one and is a prerequisite for the following type. It would be expected that the size of correlations would increase as subtests progress through such a cumulative hierarchy. In general, this increase in size of correlation was observable. An example is the low correlation of .08 between Stimulus-Response and Motor Imitation, and the higher correlation of .74 between Multiple Discrimination and Concept Development which occurs at the top of the hierarchy (Table 22).

2. The language inventory subtests correlated moderately with age. A probable factor contributing to a lack of higher correlation could be the restriction of age to four half-year groups. There is evidence that age may have been an important influence in the higher correlations for the more

complex subtests (Verbal Association, .56; Multiple Discrimination, .59; and Concept Development, .58). Conversely, age contributed less influence on the correlations for the Stimulus-Response (.06) and Motor Imitation (.32) subtests.

3. The study of subtest correlations with age controlled for revealed some communalities of measurement. With four subtests representing chaining as a type of learning, some high correlations were expected. The combinations of the four chaining subtests (Motor Imitation, Vocal Imitation, Chaining Objects, and Chaining Actions) had correlations ranging from .28 to .64. Chaining Objects and Chaining Actions correlated the highest. It may also be seen that Verbal Association, Multiple Discrimination and Concept Development correlated rather highly. The combination of these subtests correlated from .48 to .74. Common test material and involvement of the same preceding types of learning may be one determinant in the interrelationships of these three subtests.

CHAPTER VIII

ANALYSIS OF DIFFICULTY LEVEL OF ITEMS IN THE LANGUAGE INVENTORY

Ordering of items in the present battery of subtests was based upon an analysis of item difficulties and proportion passing each item on a pilot language inventory. The results gained from the preliminary form of the language inventory were used to select items having a range of difficulty from approximately twenty to eighty percent of all subjects passing.

For the five subtests having a dichotomous scoring system, the proportion passing items on these subtests will be discussed. For the three subtests having a cumulative credit scoring system, difficulty levels will be discussed in terms of item means. Item statistics for the subtests may be found in Appendix B, Table 1-8.

Stimulus-Response

Upon analyzing mean scores of subtest items (Appendix B, Table 1), it was apparent that many items had similar means. The means were also high, indicating that full credit was given for most items to subjects in all age groups. Consequently, this subtest appeared to have too many easy items and no items which discriminated between the 8-6 and 9-6 age groups. This was also revealed in the curve of means in Figure 1.

Motor Imitation

In this subtest six of the seventeen items were passed by 81 to 97 percent of all the subjects. Two of the items were passed by 14 percent or less of all subjects. There were no items representing 40 percent passing and only one item having 50 percent passing. There was also only one item having 30 percent passing. These percentages indicate that too many of the items were too easy and not enough items were included having a "middle" (30, 40 and 50 percent) proportion passing. The lack of discriminating ability of some of these items could account for the lack of differentiation of the curve of means in Figure 2. In terms of item order from the easiest to the most difficult, the items appear to be generally correctly arranged.

Vocal Imitation

In terms of item difficulty, the major part of the subtest items appears to be appropriately graduated in order of difficulty. The latter third of the test items appear to need some rearrangement. The range of percents for proportion passing was from .21 to .81. These difficulty margins appear to be ideal, but the internal range of proportion passing individual items needs further attention. Seven items had 62 to 69 percent passing. Eight items had 40 to 48 percent passing. These percentages account for more than half of the 22 subtest items. The lack of distribution of proportion passing at the 20, 30 and 50 percent levels may have some influence on the curve of means, especially when age and IQ are examined in Figure 3.

Chaining Objects

In an analysis of means of items for this subtest, it was evident that many of the means were at about the same level of difficulty. The easy items, lacking a range of difficulty, did not discriminate between the two oldest age groups (8-6 and 9-6). A suggested item order for the present subtest is presented in Appendix B, Table 4.

Chaining Actions

The means of the Chaining Actions subtest also appear to be high, indicating a restricted spread in the difficulty level of the items. This subtest also reflects a lack of discrimination between the 8-6 and 9-6 age groups. The ordering of items generally appears to be from the easiest to the most difficult, but the internal arrangement of items was more random. Item statistics and a suggested item order are presented in Appendix B, Table 5.

Verbal Association

The range in proportion of subjects passing items on this subtest was from 20 to 95 percent. There were five items in which the proportion passing was 81 to 95 percent. None of the items had less than 20 percent passing. With the exception of a few "easy" items, the range of percentages passing the subtest items was acceptable. The age groups were differentiated as seen in the range of means in Figure 6. Ordering of items appeared to follow the easy to difficult progression.

Multiple Discrimination

On the Multiple Discrimination subtest, the range of item difficulty, based on proportion passing, was from 41 to 89 percent. Eighty-two to eighty-nine percent of the subjects passed six of the items. There were no items having 20 to 40 percent passing. This may be taken as an indication of too many easy items and not enough items in the middle (50 to 59 percent) and lower (20 to 40 percent) difficulty ranges. Although there was differentiation of the four age groups, more difficult items may have increased the range between means for the groups.

Concept Development

The proportion of subjects passing items on the Concept Development subtest ranged from 17 to 87 percent. Three items were over the 80 percent passing margin and two items were below the 20 percent passing margin in terms of item difficulty. A slightly larger percentage of items was passed at or above the 50 percent passing level than for items having 17 to 50 percent passing. A larger number of total test items having a higher difficulty index could make the subtest even more discriminatory between ages.

Summary

Percentages of subjects passing subtest items and the range of difficulty across items were examined. There was a tendency for the subtests having a task analytic and cumulative scoring system (Stimulus-Response, Chaining Objects and Chaining Actions) to have a preponderance of easy items. More difficult items were needed on the majority of subtests in order to effect more differentiation between the 8-6 and 9-6 age groups. A suggested reordering of items in the subtests was also presented (Appendix B, Tables 1-8).

CHAPTER IX

SUMMARY AND CONCLUSIONS

Purpose

The purpose of this study was to develop a language inventory which would measure language products of severely retarded children, ages six and one-half to ten.

Theoretical Construct of the Inventory

In this study, five of Gagné's eight types of learning were selected for describing language products. Eight subtests were constructed to accompany these learning types. The subtests are (1) Stimulus Response, (2) Motor Imitation, (3) Vocal Imitation, (4) Chaining Objects, (5) Chaining Actions, (6) Verbal Association, (7) Multiple Discrimination, and (8) Concept Development. Collectively, these subtests form a language inventory describing five levels of language learning.

Procedures

The language inventory was given to 160 children between the ages of six and one-half and ten with Stanford-Binet IQ's from 35 to 55. Preliminary reliability for the subtests was established by readministration of the inventory to a group of the original subjects. Item consistency reliability estimates for combined and separate age groups on each subtest were computed also. A preliminary validity study was conducted in which age and high and low IQ groups were analyzed for linear growth functions.

Results

1. Significant sex differences were observed on only one subtest (Chaining Actions).

2. IQ was significant as a source of variance for all subtests.

3. Age was significant as a source of variance on all subtests with the exception of the Stimulus-Response subtest.

4. The interaction of age and IQ was not significant for any of the subtests.

5. Mean scores demonstrated a linear progression with age for the Verbal Association, Multiple Discrimination and Concept Development subtests.

6. The trend of mean scores was generally upward for the 6-6, 7-6 and 8-6 age groups. For the 9-6 group, there was a reduced increase of mean scores on Motor Imitation and Vocal Imitation, and little increase or a slight downward trend on the Stimulus-Response, Chaining Objects and Chaining Actions subtests.

7. Reliability estimates were relatively high for all the subtests. The range of coefficient values was from .61 to .89.

8. When separate reliability estimates for the subtests were obtained for each age group, seven of the subtests had coefficients which ranged from .62 to .96. For Stimulus-Response the range was .86 to .96; for Vocal Imitation from .83 to .89 and for Verbal Association from .79 to .91.

9. The Motor Imitation subtest had lower reliability estimates, ranging from .05 to .72, across age groups.

10. Test-retest correlations for the eight subtests were between .77 and .94 except for Stimulus-Response which had a correlation of .34.

11. Intercorrelations among the various subtests were moderately low

when CA was controlled by partial correlation, suggesting some measurement of independent functions.

12. In the study of subtest intercorrelations, larger correlations were noted between subtests higher in the theoretical hierarchy.

13. The language inventory subtests correlated moderately with age, despite the restricted age range used in this study.

Conclusions

A number of restrictions must be considered with regard to generalizations made from this investigation of procedures for measuring language. The children selected for participation in the study were all enrolled in public day school classes for the trainable mentally handicapped. They do not represent all young children having IQ's between 35 and 55. Other groups of children with similar characteristics, such as those who reside in institutions for the mentally handicapped and those who have sensory impairments, were not included in the sample. Although various community sizes, ranging from rural to urban, were represented, no attempt was made to control for this factor. Also, the number of children (40 in each age group) was relatively small.

Contingent upon the restrictions noted above, the following tentative conclusions were drawn:

1. The Stimulus-Response subtest appeared to be too easy for most subjects. The range of mean scores was consistently high across ages, with the most difficult item having 75 percent of all subjects passing. It is recommended that this subtest be dropped from the battery of subtests.

2. For the Chaining Objects and Chaining Actions subtest, there was little or no increase of mean scores between the 8-6 and 9-6 age groups. A

number of items with similar difficulty levels, which were passed by most subjects, could have contributed to the results. The motor responses required with these subtests may have been inappropriate for older children. A corresponding verbal response might have been more appropriate. It is recommended that more complex items be added to these subtests in an effort to provide a wider range of difficulty levels.

3. More difficult items are needed to differentiate between the 8-6 and 9-6 age groups on the Motor Imitation, Vocal Imitation, Chaining Objects and Chaining Actions subtests.

4. Administration of the language inventory to groups of five and five and one-half year old subjects could be useful and thus provide information on more age levels.

5. The size of subtest intercorrelations tended to increase as the more complex types of learning were represented. This was taken as an indication that the subtests reflected the cumulative effects of the theoretical hierarchy, wherein each preceding type of learning is prerequisite for the next.

Suggestions for Future Study

1. A language inventory was constructed and given to a sample of 160 young mentally retarded children. Subsequent analyses of the subtests in the inventory gave evidence that certain revisions were needed. These revisions were noted above in the Conclusions section. After these revisions are made, the inventory should be given to a larger group of children within the same intelligence and chronological age ranges. Children enrolled in private date-care centers and those residing in institutions for the mentally retarded should also be included in order to obtain a more representative sample of this

population.

2. Further validity studies of the inventory should be made. The performance of other groups of young children on this inventory might be investigated. Such groups would include those diagnosed as low-verbal, aphasic and autistic. Analysis of their responses might indicate common areas of ability or disability.

3. The language inventory might be given to a younger age group of mentally retarded children such as those with CA's between 5-6 and 5-11. This would give data on the performance of a group of children who may not yet be enrolled in public or private day schools.

4. A study of examiner equivalence should be undertaken to answer the question, "Do different examiners obtain equivalent results when using the language inventory?" This investigation should involve classroom teachers as this instrument was designed primarily for their use.

5. A future step could also involve the construction and use of a language curriculum which follows the theoretical construct on which the language inventory is based.

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APPENDIX A

SUMMARY OF ANALYSIS OF VARIANCE

Stimulus-Response Subtest

Source	Sum of Squares	Mean Square	df	F ratio	Probability
A (Age)	276.2304	92.0768	3	1.4300	.2365
B (IQ)	925.6082	925.6082	1	14.3756	.0002
C (Sex)	42.5074	42.5074	1	.6602	.4178
AXB	189.2706	63.0902	3	.9798	.4041
AXC	55.7157	18.5719	3	.2884	.8337
BXC	6.6152	6.6152	1	.1027	.7490
AXBXC	283.0896	94.3632	3	1.4655	.2265

Motor Imitation Subtest

Source	Sum of Squares	Mean Squares	df	F ratio	Probability
A (Age)	143.0717	47.6906	3	6.0248	.0007
B (IQ)	77.4843	77.4843	1	9.7887	.0021
C (Sex)	15.1892	15.1892	1	1.9189	.1681
AXB	10.5065	3.5022	3	.4424	.7230
AXC	16.9944	5.6648	3	.7156	.5442
BXC	5.2761	5.2761	1	.6665	.4156
AXBXC	21.5534	7.1845	3	.9076	.4391

Vocal Imitation Subtest

Source	Sum of Squares	Mean Square	df	F ratio	Probability
A (Age)	624.7916	208.2639	3	8.1765	.0001
B (IQ)	176.0962	176.0962	1	6.9136	.0095
C (Sex)	62.5144	62.5144	1	2.4543	.1194
AXB	200.7173	66.9058	3	2.6267	.0527
AXC	138.6808	46.2269	3	1.8149	.1471
BXC	55.3529	55.3529	1	2.1732	.1426
AXBXC	34.9289	11.6429	3	.4571	.7127

Chaining Objects Subtest

Source	Sum of Squares	Mean Square	df	F ratio	Probability
A (Age)	4262.4197	1420.8066	3	9.6299	.0001
B (IQ)	3654.4404	3654.4404	1	24.7691	.0001
C (Sex)	.4332	.4332	1	.0029	.9569
AXB	53.7181	17.9060	3	.1214	.9474
AXC	190.1398	63.3799	3	.4296	.7321
AXBXC	67.9795	79.9377	1	.5418	.4629

Chaining Actions Subtest

Source	Sum of Squares	Mean Square	df	F ratio	Probability
A (Age)	666.2894	222.0965	3	10.4608	.0001
B (IQ)	409.8485	409.8485	1	19.3039	.0001
C (Sex)	84.9384	84.9384	1	4.0006	.0474
AXB	27.3248	9.1023	3	.4290	.7325
AXC	29.6388	9.8796	3	.4653	.7069
BXC	3.7646	3.7646	1	.1773	.6744
AXBXC	13.8237	4.6079	3	.2170	.8845

Verbal Association Subtest

Source	Sum of Squares	Mean Square	df	F ratio	Probability
A (Age)	1971.3953	657.1318	3	20.2253	.0001
B (IQ)	774.2567	774.2567	1	23.8302	.0001
C (Sex)	37.6717	37.6717	1	1.1595	.2834
AXB	117.0508	39.0169	3	1.2009	.3117
AXC	144.1769	48.0589	3	1.4792	.2227
BXC	.1734	.1734	1	.0053	.9419
AXBXC	28.2057	9.4019	3	.0053	.8330

Multiple Discrimination Subtest

Source	Sum of Squares	Mean Square	df	F ratio	Probability
A (Age)	1472.1549	490.7183	3	30.6311	.0001
B (IQ)	471.6757	471.6756	1	29.4424	.0001
C (Sex)	7.0172	7.0172	1	.4380	.5091
AXB	17.9948	5.9983	3	.3744	.7716
AXC	36.1022	12.0341	3	.7512	.5234
BXC	1.3278	1.3278	1	.0829	.7738
AXBXC	61.6049	20.5349	3	1.2818	.2830

Concept Development Subtest

Source	Sum of Squares	Mean Square	df	F ratio	Probability
A (Age)	1115.6050	371.8683	3	29.8981	.0001
B (IQ)	324.5130	324.5130	1	26.0916	.0001
C (Sex)	5.6089	5.6093	1	.4510	.5029
AXB	48.7135	16.2378	3	1.3056	.2750
AXC	33.1622	11.0541	3	.8888	.4486
BXC	17.3889	17.3889	1	1.3981	.2390
AXBXC	14.3041	4.7680	3	.3834	.7651

APPENDIX B

SUBTEST ITEM STATISTICS

Stimulus-Response Subtest

Original Order (Item Number)	Maximum per Item	Mean	S.D.	Item Subtest Correlation	Suggested Item Order	Mean Score as Proportion of Maximum
1	5	3.74	1.18	.31	11	.79
2	5	4.30	1.27	.58	3	.86
3	5	4.42	1.12	.63	2	.88
4	5	4.22	1.04	.59	4	.85
5	5	4.56	1.07	.68	1	.75
6	5	4.19	1.08	.73	5	.91
7	5	4.16	1.17	.68	7	.83
8	5	4.20	0.98	.53	6	.84
9	5	3.83	1.23	.50	9	.77
10	5	3.80	1.03	.62	10	.76
11	5	3.95	1.22	.62	8	.84

Motor Imitation Subtest

Original Order (Item Number)	Proportion Passing	Point Biserial Correlation	Suggested Item Order	Proportion Passing
1	.96	.34	2	.96
2	.96	.20	3	.96
3	.97	.22	1	.97
4	.91	.45	4	.91
5	.84	.50	5	.84
6	.63	.49	10	.63
7	.63	.41	11	.63
8	.81	.64	6	.81
9	.78	.51	7	.78
10	.71	.61	8	.71
11	.69	.56	9	.69
12	.58	.60	12	.58
13	.24	.36	15	.24
14	.30	.51	.13	.30
15	.27	.50	14	.27
16	.14	.37	16	.14
17	.13	.34	17	.13

Vocal Imitation Subtest

Original Order (Item Number)	Proportion Passing	Point Biserial Correlation	Suggested Item Order	Proportion Passing
1	.69	.42	4	.69
2	.64	.36	7	.64
3	.81	.61	1	.81
4	.74	.47	2	.74
5	.71	.53	3	.71
6	.67	.51	5	.67
7	.56	.60	11	.56
8	.63	.63	8	.63
9	.62	.63	9	.62
10	.63	.57	10	.63
11	.45	.45	15	.45
12	.46	.43	14	.46
13	.66	.55	6	.67
14	.42	.60	18	.42
15	.42	.56	19	.42
16	.51	.47	12	.51
17	.45	.65	16	.45
18	.48	.67	13	.48
19	.42	.56	18	.42
20	.33	.55	21	.33
21	.21	.43	22	.21
22	.44	.67	17	.44

Chaining Objects Subtest

Original Order (Item Number)	Maximum per Item	Mean	S.D.	Item-Subtest Correlation	Suggested Item Order	Mean Score as Proportion of Maximum
1	4	3.70	0.95	.35	2	.92
2	4	2.59	1.74	.28	13	.65
3	4	3.24	1.37	.60	6	.81
4	4	2.77	1.51	.52	10	.69
5	4	3.71	0.99	.40	1	.93
6	4	3.30	1.38	.48	3	.83
7	4	3.28	1.35	.48	4	.82
8	4	2.92	1.57	.51	9	.73
9	4	2.76	1.66	.57	11	.69
10	4	3.28	1.45	.58	5	.82
11	4	3.18	1.34	.55	7	.79
12	4	3.09	1.59	.38	8	.77
13	4	2.58	1.59	.40	14	.64
14	5	2.76	2.30	.31	15	.55
15	5	3.36	1.85	.55	12	.67
16	5	0.91	1.57	.28	17	.19
17	4	1.59	2.12	.37	16	.40

Chaining Action Subtest

Original Order (Item Number)	Maximum per Item	Mean	S.D.	Item-Subtest Correlation	Suggested Item Order	Mean Score as Proportion of Maximum
1	1	.73	.45	.42	7	.73
2	1	.46	.50	.36	11	.46
3	1	.24	.43	.35	12	.24
4	1	.20	.40	.36	13	.20
5	2	1.80	.59	.56	1	.90
6	2	1.77	.61	.43	3	.88
7	2	1.79	.61	.47	2	.89
8	2	1.49	.77	.43	6	.74
9	2	1.24	.92	.40	9	.62
10	2	1.21	.79	.44	10	.61
11	2	1.34	.90	.53	8	.67
12	2	.14	.51	.20	14	.14
13	3	2.51	1.04	.59	4	.84
14	3	2.40	1.13	.62	5	.80

Verbal Association Subtest

Original Order (Item Number)	Proportion Passing	Point Biserial Correlation	Suggested Item Order	Proportion Passing
1	.95	.38	1	.95
2	.91	.38	2	.91
3	.75	.49	7	.75
4	.81	.55	5	.81
5	.88	.46	3	.88
6	.71	.50	8	.71
7	.65	.47	9	.65
8	.59	.57	12	.59
9	.79	.54	6	.79
10	.64	.59	11	.64
11	.65	.60	10	.65
12	.84	.51	4	.84
13	.54	.68	16	.54
14	.57	.62	13	.57
15	.46	.55	20	.46
16	.50	.47	18	.50
17	.52	.50	17	.52
18	.56	.66	14	.56
19	.42	.65	22	.42
20	.56	.67	15	.56
21	.35	.58	26	.35
22	.47	.69	19	.47
23	.36	.52	24	.36
24	.29	.56	28	.29
25	.44	.53	21	.44
26	.41	.54	23	.41
27	.23	.25	29	.23
28	.21	.40	30	.21
29	.34	.41	27	.34
30	.20	.36	31	.20
31	.36	.50	25	.36

Multiple Discrimination Subtest

Original Order (Item Number)	Proportion Passing	Point Biserial Correlation	Suggested Item Order	Proportion Passing
1	.89	.42	1	.89
2	.89	.41	2	.89
3	.89	.23	3	.89
4	.83	.52	5	.83
5	.86	.45	4	.86
6	.67	.42	12	.67
7	.82	.56	6	.82
8	.74	.56	7	.74
9	.73	.48	9	.73
10	.71	.50	10	.71
11	.74	.33	8	.74
12	.69	.50	11	.69
13	.46	.37	22	.46
14	.64	.43	13	.69
15	.52	.53	18	.52
16	.60	.45	16	.60
17	.63	.41	14	.63
18	.47	.31	21	.47
19	.51	.35	19	.51
20	.48	.54	20	.48
21	.41	.37	25	.41
22	.61	.41	15	.61
23	.52	.52	17	.52
24	.41	.53	26	.41
25	.45	.59	23	.45
26	.42	.39	24	.42
27	.41	.54	27	.41

Concept Development Subtest

Original Order (Item Number)	Proportion Passing	Point Biserial Correlation	Suggested Item Order	Proportion Passing
1	.87	.44	1	.87
2	.84	.41	2	.84
3	.82	.60	3	.82
4	.61	.32	8	.61
5	.58	.59	10	.58
6	.51	.41	14	.51
7	.61	.49	7	.61
8	.64	.45	6	.64
9	.66	.53	5	.66
10	.56	.39	12	.56
11	.74	.61	4	.74
12	.54	.47	13	.54
13	.47	.39	15	.47
14	.40	.61	18	.40
15	.36	.49	19	.36
16	.61	.54	9	.61
17	.58	.49	11	.58
18	.42	.59	16	.42
19	.42	.45	17	.42
20	.27	.39	20	.27
21	.17	.25	22	.17
22	.24	.19	21	.24
23	.17	.22	23	.17

APPENDIX C

DIRECTIONS FOR ADMINISTERING THE LANGUAGE INVENTORY

Subtest 1--Stimulus-Response

1. The child is seated directly opposite the examiner at a table or desk.

2. Each of the objects is placed directly before the child (within 8 or 10 inches), one at a time.

3. If the child does not respond by visually attending to the object for at least 3 seconds within a 5 second interval, the examiner may point to the object.

4. To receive partial or full credit, the child must make some or all of the responses listed under each item.

5. If, after #4 above, the child has not made a response, the examiner then makes the proper responses listed (demonstration item only).

6. The examiner then replaces the object in its former position and points to the object before withdrawing his hand.

7. If the child still has not imitated the examiner after the demonstration, assist the child in making the correct actions on the first item. This item is then scored "No Response."

8. Follow the sequence of #2 through #4 for the remaining objects.

Subtest 2--Motor Imitation

1. The child is seated opposite or beside the examiner. It is necessary that the child's attention be secured before the administration of each item.

2. The examiner says, "LOOK--DO THIS" and then performs the motor act called for.

3. After demonstrating each motor act, the examiner then says, "NOW YOU DO IT." The examiner should make sure that the child (a) watched the demonstration and (b) did not begin imitation before the examiner completed the demonstration.

4. If the child does not respond within 5 seconds, the examiner may repeat #2 and #3 on the demonstration item.

5. If the child has not attempted to imitate the motor act within 5 seconds after the examiner completes the second demonstration (#4), the examiner may assist the child to make the correct response.

6. The sequence of #2 and #3 is repeated for the remaining items.

Subtest 3--Vocal Imitation

1. The child is seated opposite the examiner. It is necessary that the child's attention be secured before administration of each item.

2. The examiner says "LISTEN," followed by the listed speech sound(s).

3. After the administration of each item, the examiner then says "NOW YOU SAY IT."

4. If the child does not respond within 5 seconds, the examiner may repeat #2 and #3. On the first item, the child should be coaxed to make some response.

5. The sequence of #2 and #3 is repeated for the remaining items.

Subtest 4--Chaining Objects

1. The child is seated opposite the examiner.

2. The examiner places 3 objects before the child and says, "SHOW ME_____" (critical object listed on score form).

3. On the demonstration item, if the child makes no response within 5 seconds, the examiner says, "WATCH ME" and deliberately selects the correct object and completes all the actions involved. The examiner then says, "NOW YOU DO IT--SHOW ME_____."

4. When the child makes any of the correct gestures, scores are recorded on the score form in the blanks corresponding to the actions which are made.

5. Repeat #2 for the remaining items.

Subtest 5--Chaining Actions

1. The child is seated opposite the examiner.

2. The examiner says, "SHOW ME_____." (appropriate action)

3. On the demonstration item, if the child makes no response within 5 seconds, the examiner says, "WATCH ME" and completes all the actions involved. This is followed by the examiner saying, "NOW YOU DO IT. SHOW ME_____."

4. When the child makes any of the correct gestures, scores are recorded on the score form in the blanks corresponding to the actions which are made.

5. Repeat #2 for the remaining items.

Subtest 6--Verbal Association

1. The child is seated opposite or beside the examiner.

2. The examiner shows the child each picture and says, "WHAT IS THIS?" or "WHAT DO YOU CALL THIS?"

3. If the child makes no response within 5 seconds, the examiner may prompt by saying "THIS IS A...."

4. Responses are scored as correct if the child says the correct word (or acceptable alternate) for the picture. All responses, correct or incorrect, should be recorded.

5. Repeat the sequence of #2 through #4 for each item.

Subtests 7 & 8--Multiple Discrimination/Concept Development

1. The child is seated opposite or beside the examiner.

2. The examiner shows the child each plate of pictures (four pictures per plate) and says, "SHOW ME_____." (critical picture listed on score form).

3. If the child makes no response within 5 seconds, the examiner may prompt with "LET'S FIND_____. SHOW ME."

4. If no response is made after #3, the examiner may assist the child in pointing to the correct choice on the demonstration item.

5. Responses are scored as correct if the child points to the item named by the examiner.

6. Repeat #2 and #3 for the remaining items.

Subtest 1

Stimulus-Response

Watch (Demonstration Item)
___No response
___Looks at
___Touches
___Picks up
___Manual investigation
___Manipulates purposefully and appropriately

1. Truck
___No response
___Looks at
___Touches
___Picks up
___Manual investigation
___Manipulates purposefully and appropriately

2. Storybook
___No response
___Looks at
___Touches
___Picks up
___Manual investigation
___Manipulates purposefully and appropriately

3. Plastic Popper Beads
___No response
___Looks at
___Touches
___Picks up
___Manual investigation
___Manipulates purposefully and appropriately

4. Mirror
___No response
___Looks at
___Touches
___Picks up
___Manual investigation
___Manipulates purposefully and appropriately

5. Box (Beads)
___No response
___Looks at
___Touches
___Picks up
___Manual investigation
___Manipulates purposefully and appropriately

6. Modeling Clay
___No response
___Looks at
___Touches
___Picks up
___Manual investigation
___Manipulates purposefully and appropriately

7. Change Purse
___No response
___Looks at
___Touches
___Picks up
___Manual investigation
___Manipulates purposefully and appropriately

8. Drum ___No response
___Looks at
___Touches
___Picks up
___Manual investigation
___Manipulates purposefully and appropriately

9. Toy Animal ___No response
___Looks at
___Touches
___Picks up
___Manual investigation
___Manipulates purposefully and appropriately

10. Wrapped Candy ___No response
___Looks at
___Touches
___Picks up
___Manual investigation
___Manipulates purposefully and appropriately

Subtest 2

Motor Imitation

Visual and Vocal Stimuli	Response	
	Imitates (✓)	Did not imitate (—)
Demo: Stand up		
1. Raise hand		
2. Pat cheek		
3. Blow		
4. Stand up - jump		
5. Sit down - put hands over eyes		
6. Touch nose - touch ear		
7. Raise hand - hit table		
8. Pat cheek - blow		
9. Clap hands - hands over eyes		
10. Hands on head - clap hands		
11. Hit table - stand up - jump		
12. Pat cheek - pat knees - put hands on head		
13. Swing legs - touch nose - hit table		
14. Hand on head - clap hands - hit table		
15. Touch mouth - touch ear - touch nose		
16. Stand up - turn around - jump - blow		

Subtest 3

Vocal Imitation

Stimulus	Correct (✓)	Incorrect (record)
1. ni		
2. ma		
3. ka		
4. do		
5. re		
6. gu		
7. yu		
8. so		
9. loo		
10. wa		
11. bop		
12. vu		
13. fi		
14. do-ni		
15. je		
16. mas		
17. yus		
18. gu-ze		
19. dof		
20. bo-yu		
21. hu-ka		
22. pu		

Code:

o = rope
oo = boot
e = me
a = rate
i = pit
a = pat
o = lot
u = use
u = up
e = pet
g = gun

Subtest 4

Chaining Objects

Drinking (glass)
___No response
___Looks at
___Touches
___Picks up
___Brings to mouth

1. Dusting (dust cloth)
___No response
___Looks at
___Touches
___Grasps
___Moves cloth back and forth over a surface

2. Pouring (toy coffee pot)
___No response
___Looks at
___Touches
___Picks up
___Tips pot to one side in a pouring motion

3. Dropping (box)
___No response
___Looks at
___Touches
___Picks up
___Drops box to tabletop or floor

4. Opening (box or bottle)
___No response
___Looks at
___Touches
___Picks up
___Pulls lid off (into open position)

5. Closing
___No response
___Looks at
___Touches
___Picks up
___Pushes lid onto top

6. Breaking (toothpick)
___No response
___Looks at
___Touches
___Picks up
___Bends until toothpick breaks

7. Tearing (paper)
___No response
___Looks at
___Touches
___Picks up (both hands)
___Pulls in opposing directions until a tear appears

8. Folding (cloth)
___No response
___Looks at
___Touches
___Grasps one or two edges
___Brings one or more opposite edges together

9. Stirring (spoon & bowl)
___No response
___Looks at
___Touches spoon
___Picks spoon up
___Makes circular motion with spoon inside bowl

10. Bending (straw)
___No response
___Looks at
___Touches
___Grasps
___Makes a break (bend) in straw, about a 45°angle

11.Squeezing (plastic tube)
___No response
___Looks at
___Touches
___Picks up
___Tightens fingers over tube in squeezing action

12.Snapping (mounted snaps)
___No response
___Looks at
___Touches snap(s)
___Grasps snap
___Pushes onto another snap

13.Putting On (jar and lid)
___No response
___Looks at
___Touches lid
___Picks lid up
___Holds jar
___Puts lid on top of jar

14.Tying (shoe-string)
___No response
___Looks at
___Touches string
___Grasps string
___Crosses two sides of string (both hands)

15.Inserting (letter & envelope)
___No response
___Looks at
___Touches letter
___Touches envelope
___Grasps letter
___Puts letter in envelope

16.Fastening (hook and eye)
___No response
___Looks at
___Touches hook
___Grasps hook
___Grasps eye
___Makes attempt to put hook through eye

Subtest 5

Chaining Actions

Smiling (Demonstration Item)
___No response
___Pulls lips back across surface of teeth

1. Wiggling
___No response
___Moves some part of body (trunk, arms, legs) rapidly back & forth

2. Yawning
___No response
___Opens mouth

3. Leaning
___No response
___Moves head or torso 10° or more to left or right

4. Clapping
___No response
___Extends both hands
___Brings hands together suddenly--producing sound

5. Sleeping
___No response
___Closes eyes
___Bows head

6. Washing (face)
___No response
___Bows head
___Moves hand(s) over face

7. Touching
___No response
___Extends hand toward some object, part of body,etc.
___Touches (makes contact with object)

8. Pointing
___No response
___Raises arm to form straight line
___Extends forefinger

9. Laughing
___No response
___Pulls lips back into smile

10. Rubbing
___No response
___Extends hands
___Moves hand(s) back and forth across a surface

11. Nodding
___No response
___Bends head down
___Raises head up

12. Combing
___No response
___Extends hand
___Raises hand to head
___Moves hand over portion of head at least 2 times

13. Scratching
___No response
___Moves hand to some part of body or other surface
___Curves fingers
___Moves curved fingers over surface

Subtest 6

Verbal Association

Stimulus	Label Given	Stimulus	Label Given
Demonstration Item: Automobile	______		______
1. ball	______	16. iron	______
2. cup	______	17. turtle	______
3. book	______	18. candle	______
4. dog	______	19. balloon	______
5. cake	______	20. fire	______
6. couch	______	21. falling	______
7. package	______	22. toothbrush	______
8. scissors	______	23. nest	______
9. monkey	______	24. sink	______
10. slide	______	25. bowl	______
11. hand	______	26. sitting	______
12. umbrella	______	27. chick	______
13. running	______	28. brush	______
14. bucket	______	29. mixer	______
15. toilet	______	30. necklace	______

Subtest 7

Multiple Discrimination

Critical Object	Foils			Correct Response (in parentheses)
Mother	1 baby	2 man	3 boy	(4)
1. Boot	1 slippers	2 belt	4 pumps	(3)
2. Spoon	1 fork	2 knife	3 bowl	(4)
3. Hammer	1 saw	3 chisel	4 rake	(2)
4. Banana	1 carrot	2 pear	4 cherry	(3)
5. Cap	2 coat	3 mitten	4 sock	(1)
6. Girl	1 man	3 baby	4 boy	(2)
7. Snake	2 horse	3 dog	4 duck	(1)
8. Tie	1 cuff	2 mitten	4 collar	(3)
9. Squirrel	2 bird	3 chick	4 bear	(1)
10. Mailbox	1 crate	2 can	3 pail	(4)
11. Clothes hanger	1 desk	2 lamp	4 safety pin	(3)
12. Gown	1 dress	2 pants	3 blouse	(4)
13. Father	1 girl	3 woman	4 baby	(2)
14. Throwing	1 lying	3 jumping	4 falling	(2)
15. Pillow	1 rug	2 radio	3 skates	(4)
16. Needle	1 basket	2 scissors	4 thimble	(3)
17. Corn	1 grapes	3 lettuce	4 beans	(2)
18. Standing	2 sitting	3 jumping	4 lying	(2)
19. Two (2)	2 "5"	3 "3"	4 "S"	(1)
20. Hatchet	1 garbage	2 shovel	4 ladder	(3)
21. One (1)	2 "3"	3 "2"	4 "7"	(1)
22. Fan	1 lamp	3 t.v.	4 mixer	(2)
23. "A"	2 "M"	3 "E"	4 "5"	(1)
24. Waving	1 falling	2 jumping	4 lying	(3)
25. Four (4)	1 "2"	3 "6"	4 "5"	(2)
26. Kite	2 sailboat	3 top	4 tent	(1)

Subtest 8

Concept Development

Critical Object	Foils			Correct Response (in parentheses)
Meat (demo.)	1 pear	2 screwdriver	4 sock	(3)
1. Dish	2 coat	3 goat	4 potato	(1)
2. Food	1 fork/spoon	2 dog	4 car	(3)
3. Bird (hen)	1 bear	3 comb	4 cow	(2)
4. Toy	1 book	3 tree	4 pan	(2)
5. Tool (wrench)	1 doll	2 pail	4 nail	(3)
6. Furniture (sofa)	1 hamburger	2 fork	3 house	(4)
7. Building (house)	1 bowl	2 orange	3 table	(4)
8. Dessert (pie)	2 pants	3 flower	4 spoon	(1)
9. Clothing (shirt)	1 ring	2 knife	3 carrot	(4)
10. Fruit (grapes)	1 lamp	3 sweater	4 dog	(2)
11. Dirty (cloth)	1 torn	2 square	4 clean	(3)
12. Round (ball)	1 star	2 box	3 triangle	(4)
13. Jewelry (ring)	1 apple	2 sheep	4 shoe	(3)
14. Under	1 on	2 beside	4 over	(3)
15. Square	1 "2"	3 circle	4 "B"	(2)
16. Drink (pop)	1 fish	3 top	4 ladder	(2)
17. Plant (flower)	2 broom	3 pan	4 hat	(1)
18. Top	1 beside	2 on	3 apart	(4)
19. One	2 "5"	3 "3"	4 "2"	(1)
20. Widest	2 least	3 less	4 lesser	(1)
21. Insect	1 belt	3 pig	4 horn	(2)
22. Vegetable	1 elephant	2 hat	3 ham	(4)

APPENDIX D

RAW DATA

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* * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

                   MOTOR IMITATION

                   KEYED SCORE

              SUMMARY OF TEST STATISTICS

          NUMBER OF ITEMS                       17

          MEAN SCORE                         10.55

          MEDIAN SCORE                       11.04

          STANDARD DEVIATION                  3.06

          RELIABILITY (KR-20)                0.769

          RELIABILITY (KR-21)                0.610

          S.E. OF MEASUREMENT                 1.91

          POSSIBLE LOW SCORE                     0
          POSSIBLE HIGH SCORE                   17

          OBTAINED LOW SCORE                     2
          OBTAINED HIGH SCORE                   16

          NUMBER OF SCORES                     160
               BLANK SCORES                      0
               INVALID SCORES                    0
               VALID SCORES                    160

      SPEARMAN-BROWN PROPHESY FORMULA---IN ORDER FOR THIS
       TEST TO OBTAIN A RELIABILITY OF .90 IT MUST BE
            4.76 LONGER.  ( 81 ADDITIONAL ITEMS).
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                                * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM   1     PERCENT OF CORRECT RESPONSE BY FIFTHS           MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                      0     1  OMIT
1ST  +                                                 *    1ST       0    45     0
2ND  +                                                 *    2ND       0    23     0
3RD  +                                                 *    3RD       0    40     0
4TH  +                                             *        4TH       2    28     0
5TH  +                                       *              5TH       4    18     0
     +----+----+----+----+----+----+----+----+----+----+
     C   10   20   30   40   50   60   70   80   90  100    PROP   0.04  0.96  0.00
                                                            RPBI  -0.34  0.34  0.00

ITEM   2     PERCENT OF CORRECT RESPONSE BY FIFTHS           MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                      0     1  OMIT
1ST  +                                                 *    1ST       0    45     0
2ND  +                                              *       2ND       1    22     0
3RD  +                                                 *    3RD       0    40     0
4TH  +                                            *         4TH       3    27     0
5TH  +                                            *         5TH       2    20     0
     +----+----+----+----+----+----+----+----+----+----+
     C   10   20   30   40   50   60   70   80   90  100    PROP   0.04  0.96  0.00
                                                            RPBI  -0.20  0.20  0.00

ITEM   3     PERCENT OF CORRECT RESPONSE BY FIFTHS           MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                      0     1  OMIT
1ST  +                                               *      1ST       1    44     0
2ND  +                                                 *    2ND       0    23     0
3RD  +                                               *      3RD       1    39     0
4TH  +                                                 *    4TH       0    30     0
5TH  +                                          *           5TH       3    19     0
     +----+----+----+----+----+----+----+----+----+----+
     C   10   20   30   40   50   60   70   80   90  100    PROP   0.03  0.97  0.00
                                                            RPBI  -0.22  0.22  0.00

ITEM   4     PERCENT OF CORRECT RESPONSE BY FIFTHS           MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                      0     1  OMIT
1ST  +                                                 *    1ST       0    45     0
2ND  +                                              *       2ND       1    22     0
3RD  +                                             *        3RD       3    37     0
4TH  +                                               *      4TH       1    29     0
5TH  +                            *                         5TH       9    13     0
     +----+----+----+----+----+----+----+----+----+----+
     C   10   20   30   40   50   60   70   80   90  100    PROP   0.09  0.91  0.00
                                                            RPBI  -0.45  0.45  0.00
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                         * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM   5     PERCENT OF CORRECT RESPONSE BY FIFTHS             MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                         0      1   OMIT
   1ST +                                               *       1ST       1     44      0
   2ND +                                            *          2ND       2     21      0
   3RD +                                              *        3RD       2     38      0
   4TH +                                     *                 4TH       7     23      0
   5TH +                 *                                     5TH      14      8      0
       +----+----+----+----+----+----+----+----+----+----+
       0    10   20   30   40   50   60   70   80   90  100    PROP   0.16   0.84   0.00
                                                               RPBI  -0.50   0.50   0.00

ITEM   6     PERCENT OF CORRECT RESPONSE BY FIFTHS             MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                         0      1   OMIT
   1ST +                                            *          1ST       4     41      0
   2ND +                             *                         2ND       9     14      0
   3RD +                                *                      3RD      13     27      0
   4TH +                             *                         4TH      12     18      0
   5TH + *                                                     5TH      21      1      0
       +----+----+----+----+----+----+----+----+----+----+
       0    10   20   30   40   50   60   70   80   90  100    PROP   0.37   0.63   0.00
                                                               RPBI  -0.49   0.49   0.00

ITEM   7     PERCENT OF CORRECT RESPONSE BY FIFTHS             MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                         0      1   OMIT
   1ST +                                           *           1ST       5     40      0
   2ND +                                      *                2ND       5     18      0
   3RD +                             *                         3RD      16     24      0
   4TH +                 *                                     4TH      19     11      0
   5TH +              *                                        5TH      15      7      0
       +----+----+----+----+----+----+----+----+----+----+
       0    10   20   30   40   50   60   70   80   90  100    PROP   0.38   0.63   0.00
                                                               RPBI  -0.41   0.41   0.00

ITEM   8     PERCENT OF CORRECT RESPONSE BY FIFTHS             MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                         0      1   OMIT
   1ST +                                               *       1ST       1     44      0
   2ND +                                                 *     2ND       0     23      0
   3RD +                                          *            3RD       5     35      0
   4TH +                                     *                 4TH       7     23      0
   5TH +        *                                              5TH      18      4      0
       +----+----+----+----+----+----+----+----+----+----+
       0    10   20   30   40   50   60   70   80   90  100    PROP   0.19   0.81   0.00
                                                               RPBI  -0.64   0.64   0.00
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                                        * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM   9      PERCENT OF CORRECT RESPONSE BY FIFTHS                   MATRIX OF RESPONSES BY FIFTHS          1 IS CORRECT RESPONSE
                                                                               0     1  OMIT
1ST +                                                         *       1ST      1    44     0
2ND +                                                 *               2ND      4    19     0
3RD +                                                 *               3RD      7    33     0
4TH +                                           *                     4TH      8    22     0
5TH +                  *                                              5TH     15     7     0
    +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
    C    10    20    30    40    50    60    70    80    90   100     PROP  0.22  0.78  0.00
                                                                      RPBI -0.51  0.51  0.00

ITEM  10      PERCENT OF CORRECT RESPONSE BY FIFTHS                   MATRIX OF RESPONSES BY FIFTHS          1 IS CORRECT RESPONSE
                                                                               0     1  OMIT
1ST +                                                           *     1ST      0    45     0
2ND +                                                   *             2ND      3    20     0
3RD +                                         *                       3RD     12    28     0
4TH +                                 *                               4TH     13    17     0
5TH +       *                                                         5TH     19     3     0
    +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
    C    10    20    30    40    50    60    70    80    90   100     PROP  0.29  0.71  0.00
                                                                      RPBI -0.61  0.61  0.00

ITEM  11      PERCENT OF CORRECT RESPONSE BY FIFTHS                   MATRIX OF RESPONSES BY FIFTHS          1 IS CORRECT RESPONSE
                                                                               0     1  OMIT
1ST +                                                        *        1ST      2    43     0
2ND +                                                      *          2ND      2    21     0
3RD +                                           *                     3RD     11    29     0
4TH +                         *                                       4TH     17    13     0
5TH +             *                                                   5TH     17     5     0
    +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
    C    10    20    30    40    50    60    70    80    90   100     PROP  0.31  0.69  0.00
                                                                      RPBI -0.56  0.56  0.00

ITEM  12      PERCENT OF CORRECT RESPONSE BY FIFTHS                   MATRIX OF RESPONSES BY FIFTHS          1 IS CORRECT RESPONSE
                                                                               0     1  OMIT
1ST +                                                 *               1ST      7    38     0
2ND +                                           *                     2ND      6    17     0
3RD +                                            *                    3RD     10    30     0
4TH +               *                                                 4TH     22     8     0
5TH *                                                                 5TH     22     0     0
    +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
    C    10    20    30    40    50    60    70    80    90   100     PROP  0.42  0.58  0.00
                                                                      RPBI -0.60  0.60  0.00
```

```
                 * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM  13      PERCENT OF CORRECT RESPONSE BY FIFTHS         MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                     0     1  OMIT
  1ST +                       *                             1ST     23    22     0
  2ND +       *                                             2ND     19     4     0
  3RD +      *                                              3RD     34     6     0
  4TH +         *                                           4TH     24     6     0
  5TH *                                                     5TH     22     0     0
      +----+----+----+----+----+----+----+----+----+----+
      0    10   20   30   40   50   60   70   80   90   100 PROP  0.76  0.24  0.00
                                                            RPBI -0.36  0.36  0.00

ITEM  14      PERCENT OF CORRECT RESPONSE BY FIFTHS         MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                     0     1  OMIT
  1ST +                              *                      1ST     17    28     0
  2ND +                             *                       2ND      9    14     0
  3RD +     *                                               3RD     35     5     0
  4TH +*                                                    4TH     29     1     0
  5TH *                                                     5TH     22     0     0
      +----+----+----+----+----+----+----+----+----+----+
      0    10   20   30   40   50   60   70   80   90   100 PROP  0.70  0.30  0.00
                                                            RPBI -0.51  0.51  0.00

ITEM  15      PERCENT OF CORRECT RESPONSE BY FIFTHS         MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                     0     1  OMIT
  1ST +                              *                      1ST     17    28     0
  2ND +              *                                      2ND     16     7     0
  3RD +         *                                           3RD     32     8     0
  4TH +*                                                    4TH     29     1     0
  5TH *                                                     5TH     22     0     0
      +----+----+----+----+----+----+----+----+----+----+
      0    10   20   30   40   50   60   70   80   90   100 PROP  0.72  0.27  0.00
                                                            RPBI -0.50  0.50  0.00

ITEM  16      PERCENT OF CORRECT RESPONSE BY FIFTHS         MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                     0     1  OMIT
  1ST +               *                                     1ST     30    15     0
  2ND +       *                                             2ND     19     4     0
  3RD +   *                                                 3RD     36     4     0
  4TH *                                                     4TH     30     0     0
  5TH *                                                     5TH     22     0     0
      +----+----+----+----+----+----+----+----+----+----+
      0    10   20   30   40   50   60   70   80   90   100 PROP  0.86  0.14  0.00
                                                            RPBI -0.37  0.37  0.00
```

```
                         * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM  17      PERCENT OF CORRECT RESPONSE BY FIFTHS          MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                     0     1  OMIT
    1ST +            *                                       1ST    33    12     0
    2ND +       *                                            2ND    19     4     0
    3RD +  *                                                 3RD    37     3     0
    4TH +*                                                   4TH    29     1     0
    5TH *                                                    5TH    22     0     0
        +----+----+----+----+----+----+----+----+----+----+
        0   10   20   30   40   50   60   70   80   90  100    PROP   0.88  0.13  0.00
                                                             RPBI  -0.34  0.34  0.00
```

```
* * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

                   VOCAL IMITATION

                   KEYED SCORE

               SUMMARY OF TEST STATISTICS

         NUMBER OF ITEMS                           22

         MEAN SCORE                             11.94

         MEDIAN SCORE                           12.50

         STANDARD DEVIATION                      5.76

         RELIABILITY (KR-20)                    0.890

         RELIABILITY (KR-21)                    0.875

         S.E. OF MEASUREMENT                     2.03

         POSSIBLE LOW SCORE                         0
         POSSIBLE HIGH SCORE                       22

         OBTAINED LOW SCORE                         0
         OBTAINED HIGH SCORE                       21

         NUMBER OF SCORES                         160
              BLANK SCORES                          0
              INVALID SCORES                        0
              VALID SCORES                        160

      SPEARMAN-BROWN PROPHESY FORMULA---IN ORDER FOR THIS
       TEST TO OBTAIN A RELIABILITY OF .90 (IT MUST BE
           0.28 LONGER. (  6 ADDITIONAL ITEMS).
```

```
* * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

                                   VOCAL IMITATION

                                   KEYED SCORE

                              TEST FREQUENCY DISTRIBUTION

 RAW   STANDARD    PER                          CUM
SCORE    SCORE   CENTILE  PERCENT    FREQ     FREQ
                                                        EACH * REPRESENTS  1 PERSON(S)
  21      657      99        1.9       3      160       ***
  20      640      98        6.9      11      157       ***********
  19      623      91        3.1       5      146       *****
  18      605      88        6.3      10      141       **********
  17      588      82        5.0       8      131       ********
  16      570      77       11.2      18      123       ******************
  15      553      66        5.6       9      105       *********
  14      536      60        6.3      10       96       **********
  13      518      54        3.7       6       86       ******
  12      501      50        8.1      13       80       *************
  11      484      42        5.0       8       67       ********
  10      466      37        6.3      10       59       **********
   9      449      31        5.6       9       49       *********
   8      432      25        2.5       4       40       ****
   7      414      22        2.5       4       36       ****
   6      397      20        1.2       2       32       **
   5      379      19        3.7       6       30       ******
   4      362      15        5.0       8       24       ********
   3      345      10        1.9       3       16       ***
   2      327       8        1.9       3       13       ***
   1      310       6        1.2       2       10       **
   0      293       5        5.0       8        8       ********
```

```
                           * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM   1      PERCENT OF CORRECT RESPONSE BY FIFTHS           MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                        0     1  OMIT
  1ST +                                          *            1ST       5    32     0
  2ND +                                           *           2ND       3    24     0
  3RD +                                  *                    3RD      11    26     0
  4TH +                                *                      4TH       9    18     0
  5TH +                *                                      5TH      21    11     0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100    PROP    0.31  0.69  0.00
                                                             RPBI   -0.42  0.42  0.00

ITEM   2      PERCENT OF CORRECT RESPONSE BY FIFTHS           MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                        0     1  OMIT
  1ST +                                          *            1ST       5    32     0
  2ND +                              *                        2ND      10    17     0
  3RD +                                *                      3RD      12    25     0
  4TH +                          *                            4TH      12    15     0
  5TH +                   *                                   5TH      19    13     0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100    PROP    0.36  0.64  0.00
                                                             RPBI   -0.36  0.36  0.00

ITEM   3      PERCENT OF CORRECT RESPONSE BY FIFTHS           MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                        0     1  OMIT
  1ST +                                                 *     1ST       0    37     0
  2ND +                                                 *     2ND       0    27     0
  3RD +                                              *        3RD       2    35     0
  4TH +                                    *                  4TH       7    20     0
  5TH +                *                                      5TH      21    11     0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100    PROP    0.19  0.81  0.00
                                                             RPBI   -0.61  0.61  0.00

ITEM   4      PERCENT OF CORRECT RESPONSE BY FIFTHS           MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                        0     1  OMIT
  1ST +                                            *          1ST       3    34     0
  2ND +                                         *             2ND       4    23     0
  3RD +                                      *                3RD       8    29     0
  4TH +                                     *                 4TH       6    21     0
  5TH +                *                                      5TH      21    11     0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100    PROP    0.26  0.74  0.00
                                                             RPBI   -0.47  0.47  0.00
```

```
                    * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM   5     PERCENT OF CORRECT RESPONSE BY FIFTHS          MATRIX OF RESPONSES BY FIFTHS               1 IS CORRECT RESPONSE

                                                                      0      1   OMIT
  1ST +                                           *         1ST      4     33      0
  2ND +                                           *         2ND      3     24      0
  3RD +                                          *          3RD      5     32      0
  4TH +                              *                      4TH     10     17      0
  5TH +         *                                           5TH     25      7      0
      +----+----+----+----+----+----+----+----+----+----+
      0    10   20   30   40   50   60   70   80   90   100   PROP   0.29   0.71   0.00
                                                            RPBI  -0.53   0.53   0.00

ITEM   6     PERCENT OF CORRECT RESPONSE BY FIFTHS          MATRIX OF RESPONSES BY FIFTHS               1 IS CORRECT RESPONSE

                                                                      0      1   OMIT
  1ST +                                              *      1ST      2     35      0
  2ND +                                       *             2ND      5     22      0
  3RD +                                   *                 3RD     10     27      0
  4TH +                     *                               4TH     15     12      0
  5TH +                *                                    5TH     21     11      0
      +----+----+----+----+----+----+----+----+----+----+
      0    10   20   30   40   50   60   70   80   90   100   PROP   0.33   0.67   0.00
                                                            RPBI  -0.51   0.51   0.00

ITEM   7     PERCENT OF CORRECT RESPONSE BY FIFTHS          MATRIX OF RESPONSES BY FIFTHS               1 IS CORRECT RESPONSE

                                                                      0      1   OMIT
  1ST +                                              *      1ST      2     35      0
  2ND +                                         *           2ND      4     23      0
  3RD +                    *                                3RD     21     16      0
  4TH +                     *                               4TH     15     12      0
  5TH +     *                                               5TH     28      4      0
      +----+----+----+----+----+----+----+----+----+----+
      0    10   20   30   40   50   60   70   80   90   100   PROP   0.44   0.56   0.00
                                                            RPBI  -0.60   0.60   0.00

ITEM   8     PERCENT OF CORRECT RESPONSE BY FIFTHS          MATRIX OF RESPONSES BY FIFTHS               1 IS CORRECT RESPONSE

                                                                      0      1   OMIT
  1ST +                                              *      1ST      2     35      0
  2ND +                                               *     2ND      1     26      0
  3RD +                        *                            3RD     18     19      0
  4TH +                                  *                  4TH      8     19      0
  5TH +  *                                                  5TH     30      2      0
      +----+----+----+----+----+----+----+----+----+----+
      0    10   20   30   40   50   60   70   80   90   100   PROP   0.37   0.63   0.00
                                                            RPBI  -0.63   0.63   0.00
```

```
              * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM   9       PERCENT OF CORRECT RESPONSE BY FIFTHS        MATRIX OF RESPONSES BY FIFTHS               1 IS CORRECT RESPONSE

                                                                      0     1  OMIT
1ST +                                              *        1ST      2    35     0
2ND +                                       *               2ND      5    22     0
3RD +                                   *                   3RD     10    27     0
4TH +                   *                                   4TH     16    11     0
5TH +     *                                                 5TH     28     4     0
    +----+----+----+----+----+----+----+----+----+----+
    0    10   20   30   40   50   60   70   80   90   100   PROP  0.38  0.62  0.00
                                                            RPBI -0.63  0.63  0.00

ITEM  10       PERCENT OF CORRECT RESPONSE BY FIFTHS        MATRIX OF RESPONSES BY FIFTHS               1 IS CORRECT RESPONSE

                                                                      0     1  OMIT
1ST +                                              *        1ST      2    35     0
2ND +                                     *                 2ND      6    21     0
3RD +                                  *                    3RD     11    26     0
4TH +                        *                              4TH     13    14     0
5TH +     *                                                 5TH     28     4     0
    +----+----+----+----+----+----+----+----+----+----+
    0    10   20   30   40   50   60   70   80   90   100   PROP  0.38  0.63  0.00
                                                            RPBI -0.57  0.57  0.00

ITEM  11       PERCENT OF CORRECT RESPONSE BY FIFTHS        MATRIX OF RESPONSES BY FIFTHS               1 IS CORRECT RESPONSE

                                                                      0     1  OMIT
1ST +                                  *                    1ST     11    26     0
2ND +                            *                          2ND     11    16     0
3RD +                          *                            3RD     17    20     0
4TH +          *                                            4TH     21     6     0
5TH +     *                                                 5TH     28     4     0
    +----+----+----+----+----+----+----+----+----+----+
    0    10   20   30   40   50   60   70   80   90   100   PROP  0.55  0.45  0.00
                                                            RPBI -0.45  0.45  0.00

ITEM  12       PERCENT OF CORRECT RESPONSE BY FIFTHS        MATRIX OF RESPONSES BY FIFTHS               1 IS CORRECT RESPONSE

                                                                      0     1  OMIT
1ST +                                  *                    1ST     11    26     0
2ND +                        *                              2ND     13    14     0
3RD +                          *                            3RD     17    20     0
4TH +               *                                       4TH     18     9     0
5TH +     *                                                 5TH     28     4     0
    +----+----+----+----+----+----+----+----+----+----+
    0    10   20   30   40   50   60   70   80   90   100   PROP  0.54  0.46  0.00
                                                            RPBI -0.43  0.43  0.00
```

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                    * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM  13    PERCENT OF CORRECT RESPONSE BY FIFTHS                      MATRIX OF RESPONSES BY FIFTHS          1 IS CORRECT RESPONSE

                                                                                  0     1  OMIT
  1ST +                                                *               1ST        6    31     0
  2ND +                                               *                2ND        5    22     0
  3RD +                                               *                3RD        7    30     0
  4TH +                                         *                      4TH        8    19     0
  5TH +    *                                                           5TH       29     3     0
      +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
      0     10    20    30    40    50    60    70    80    90    100  PROP    0.34  0.66  0.00
                                                                       RPBI   -0.55  0.55  0.00

ITEM  14    PERCENT OF CORRECT RESPONSE BY FIFTHS                      MATRIX OF RESPONSES BY FIFTHS          1 IS CORRECT RESPONSE

                                                                                  0     1  OMIT
  1ST +                                               *                1ST        7    30     0
  2ND +                                       *                        2ND        9    18     0
  3RD +                   *                                            3RD       24    13     0
  4TH +            *                                                   4TH       21     6     0
  5TH *                                                                5TH       32     0     0
      +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
      0     10    20    30    40    50    60    70    80    90    100  PROP    0.58  0.42  0.00
                                                                       RPBI   -0.60  0.60  0.00

ITEM  15    PERCENT OF CORRECT RESPONSE BY FIFTHS                      MATRIX OF RESPONSES BY FIFTHS          1 IS CORRECT RESPONSE

                                                                                  0     1  OMIT
  1ST +                                                *               1ST        6    31     0
  2ND +                            *                                   2ND       14    13     0
  3RD +                       *                                        3RD       22    15     0
  4TH +             *                                                  4TH       20     7     0
  5TH +*                                                               5TH       31     1     0
      +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
      0     10    20    30    40    50    60    70    80    90    100  PROP    0.58  0.42  0.00
                                                                       RPBI   -0.56  0.56  0.00

ITEM  16    PERCENT OF CORRECT RESPONSE BY FIFTHS                      MATRIX OF RESPONSES BY FIFTHS          1 IS CORRECT RESPONSE

                                                                                  0     1  OMIT
  1ST +                                               *                1ST        7    30     0
  2ND +                                  *                             2ND       11    16     0
  3RD +                                     *                          3RD       13    24     0
  4TH +                       *                                        4TH       16    11     0
  5TH +*                                                               5TH       31     1     0
      +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
      0     10    20    30    40    50    60    70    80    90    100  PROP    0.49  0.51  0.00
                                                                       RPBI   -0.55  0.55  0.00
```

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                                        * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM  17      PERCENT OF CORRECT RESPONSE BY FIFTHS          MATRIX OF RESPONSES BY FIFTHS               1 IS CORRECT RESPONSE

                                                                        0     1  OMIT
  1ST +                                              *        1ST       2    35     0
  2ND +                                *                      2ND       9    18     0
  3RD +                *                                      3RD      24    13     0
  4TH +          *                                            4TH      21     6     0
  5TH *                                                       5TH      32     0     0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100     PROP   0.55  0.45  0.00
                                                              RPBI  -0.65  0.65  0.00

ITEM  18      PERCENT OF CORRECT RESPONSE BY FIFTHS          MATRIX OF RESPONSES BY FIFTHS               1 IS CORRECT RESPONSE

                                                                        0     1  OMIT
  1ST +                                           *           1ST       4    33     0
  2ND +                                       *               2ND       5    22     0
  3RD +                        *                              3RD      18    19     0
  4TH +    *                                                  4TH      24     3     0
  5TH *                                                       5TH      32     0     0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100     PROP   0.52  0.48  0.00
                                                              RPBI  -0.67  0.67  0.00

ITEM  19      PERCENT OF CORRECT RESPONSE BY FIFTHS          MATRIX OF RESPONSES BY FIFTHS               1 IS CORRECT RESPONSE

                                                                        0     1  OMIT
  1ST +                                   *                   1ST      10    27     0
  2ND +                            *                          2ND      11    16     0
  3RD +                       *                               3RD      19    18     0
  4TH +           *                                           4TH      20     7     0
  5TH *                                                       5TH      32     0     0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100     PROP   0.57  0.42  0.00
                                                              RPBI  -0.56  0.56  0.00

ITEM  20      PERCENT OF CORRECT RESPONSE BY FIFTHS          MATRIX OF RESPONSES BY FIFTHS               1 IS CORRECT RESPONSE

                                                                        0     1  OMIT
  1ST +                                    *                  1ST       9    28     0
  2ND +                   *                                   2ND      16    11     0
  3RD +            *                                          3RD      27    10     0
  4TH +      *                                                4TH      23     4     0
  5TH *                                                       5TH      32     0     0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100     PROP   0.67  0.33  0.00
                                                              RPBI  -0.55  0.55  0.00
```

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                         * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM  21      PERCENT OF CORRECT RESPONSE BY FIFTHS           MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                        0     1  OMIT
  1ST +                        *                              1ST      18    19     0
  2ND +               *                                       2ND      18     9     0
  3RD +    *                                                  3RD      33     4     0
  4TH +  *                                                    4TH      25     2     0
  5TH *                                                       5TH      32     0     0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100     PROP   0.79  0.21  0.00
                                                              RPBI  -0.43  0.43  0.00

ITEM  22      PERCENT OF CORRECT RESPONSE BY FIFTHS           MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                        0     1  OMIT
  1ST +                                              *        1ST       2    35     0
  2ND +                                  *                    2ND       8    19     0
  3RD +                 *                                     3RD      23    14     0
  4TH +  *                                                    4TH      25     2     0
  5TH *                                                       5TH      32     0     0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100     PROP   0.56  0.44  0.00
                                                              RPBI  -0.67  0.67  0.00
```

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* * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

                         VERBAL ASSOCIATION

                            KEYED SCORE

                     SUMMARY OF TEST STATISTICS

              NUMBER OF ITEMS                          31

              MEAN SCORE                            16.93

              MEDIAN SCORE                          16.17

              STANDARD DEVIATION                     7.42

              RELIABILITY (KR-20)                   0.914

              RELIABILITY (KR-21)                   0.889

              S.E. OF MEASUREMENT                    2.47

              POSSIBLE LOW SCORE                        0
              POSSIBLE HIGH SCORE                      31

              OBTAINED LOW SCORE                        0
              OBTAINED HIGH SCORE                      30

              NUMBER OF SCORES                        160
                   BLANK SCORES                         0
                   INVALID SCORES                       0
                   VALID SCORES                       160

          SPEARMAN-BROWN PROPHESY FORMULA---IN ORDER FOR THIS
           TEST TO OBTAIN A RELIABILITY OF .90 IT MUST BE
                0.12 LONGER.  (   4 ADDITIONAL ITEMS).
```

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                    * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM   1      PERCENT OF CORRECT RESPONSE BY FIFTHS          MATRIX OF RESPONSES BY FIFTHS             1 IS CORRECT RESPONSE

                                                                        0      1   OMIT
 1ST +                                                 *      1ST       0     33      0
 2ND +                                                 *      2ND       0     32      0
 3RD +                                                 *      3RD       0     31      0
 4TH +                                               *        4TH       1     37      0
 5TH +                                   *                    5TH       7     19      0
     +----+----+----+----+----+----+----+----+----+----+
     0    10   20   30   40   50   60   70   80   90   100    PROP   0.05   0.95   0.00
                                                              RPBI  -0.38   0.38   0.00

ITEM   2      PERCENT OF CORRECT RESPONSE BY FIFTHS          MATRIX OF RESPONSES BY FIFTHS             1 IS CORRECT RESPONSE

                                                                        0      1   OMIT
 1ST +                                                 *      1ST       0     33      0
 2ND +                                                 *      2ND       0     32      0
 3RD +                                                 *      3RD       0     31      0
 4TH +                                      *                 4TH       8     30      0
 5TH +                                     *                  5TH       6     20      0
     +----+----+----+----+----+----+----+----+----+----+
     0    10   20   30   40   50   60   70   80   90   100    PROP   0.09   0.91   0.00
                                                              RPBI  -0.38   0.38   0.00

ITEM   3      PERCENT OF CORRECT RESPONSE BY FIFTHS          MATRIX OF RESPONSES BY FIFTHS             1 IS CORRECT RESPONSE

                                                                        0      1   OMIT
 1ST +                                                 *      1ST       0     33      0
 2ND +                                             *          2ND       2     30      0
 3RD +                                          *             3RD       4     27      0
 4TH +                    *                                   4TH      22     16      0
 5TH +                         *                              5TH      12     14      0
     +----+----+----+----+----+----+----+----+----+----+
     0    10   20   30   40   50   60   70   80   90   100    PROP   0.25   0.75   0.00
                                                              RPBI  -0.49   0.49   0.00

ITEM   4      PERCENT OF CORRECT RESPONSE BY FIFTHS          MATRIX OF RESPONSES BY FIFTHS             1 IS CORRECT RESPONSE

                                                                        0      1   OMIT
 1ST +                                                 *      1ST       0     33      0
 2ND +                                                 *      2ND       0     32      0
 3RD +                                        *               3RD       5     26      0
 4TH +                                      *                 4TH       8     30      0
 5TH +              *                                         5TH      18      8      0
     +----+----+----+----+----+----+----+----+----+----+
     0    10   20   30   40   50   60   70   80   90   100    PROP   0.19   0.81   0.00
                                                              RPBI  -0.55   0.55   0.00
```

```
ITEM   5     PERCENT OF CORRECT RESPONSE BY FIFTHS                MATRIX OF RESPONSES BY FIFTHS                    1 IS CORRECT RESPONSE

                                                                           0      1   OMIT
  1ST +                                                  *        1ST      0     33      0
  2ND +                                                  *        2ND      0     32      0
  3RD +                                             *             3RD      3     28      0
  4TH +                                          *                4TH      6     32      0
  5TH +                             *                             5TH     11     15      0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100         PROP   0.13   0.88   0.00
                                                                  RPBI  -0.46   0.46   0.00

ITEM   6     PERCENT OF CORRECT RESPONSE BY FIFTHS                MATRIX OF RESPONSES BY FIFTHS                    1 IS CORRECT RESPONSE

                                                                           0      1   OMIT
  1ST +                                                *          1ST      1     32      0
  2ND +                                          *                2ND      5     27      0
  3RD +                                        *                  3RD      6     25      0
  4TH +                               *                           4TH     14     24      0
  5TH +         *                                                 5TH     21      5      0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100         PROP   0.29   0.71   0.00
                                                                  RPBI  -0.50   0.50   0.00

ITEM   7     PERCENT OF CORRECT RESPONSE BY FIFTHS                MATRIX OF RESPONSES BY FIFTHS                    1 IS CORRECT RESPONSE

                                                                           0      1   OMIT
  1ST +                                                *          1ST      1     32      0
  2ND +                                       *                   2ND      7     25      0
  3RD +                             *                             3RD     13     18      0
  4TH +                           *                               4TH     17     21      0
  5TH +               *                                           5TH     18      8      0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100         PROP   0.35   0.65   0.00
                                                                  RPBI  -0.47   0.47   0.00

ITEM   8     PERCENT OF CORRECT RESPONSE BY FIFTHS                MATRIX OF RESPONSES BY FIFTHS                    1 IS CORRECT RESPONSE

                                                                           0      1   OMIT
  1ST +                                                *          1ST      1     32      0
  2ND +                                     *                     2ND      8     24      0
  3RD +                           *                               3RD     14     17      0
  4TH +                           *                               4TH     17     21      0
  5TH +*                                                          5TH     25      1      0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100         PROP   0.41   0.59   0.00
                                                                  RPBI  -0.57   0.57   0.00
```

```
                 * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM   9      PERCENT OF CORRECT RESPONSE BY FIFTHS         MATRIX OF RESPONSES BY FIFTHS                  1 IS CORRECT RESPONSE

                                                                     0     1  OMIT
  1ST +                                               *     1ST      1    32     0
  2ND +                                                 *   2ND      0    32     0
  3RD +                                             *       3RD      2    29     0
  4TH +                                  *                  4TH     11    27     0
  5TH +            *                                        5TH     19     7     0
      +----+----+----+----+----+----+----+----+----+----+
      0    10   20   30   40   50   60   70   80   90   100 PROP  0.21  0.79  0.00
                                                            RPBI -0.54  0.54  0.00

ITEM  10      PERCENT OF CORRECT RESPONSE BY FIFTHS         MATRIX OF RESPONSES BY FIFTHS                  1 IS CORRECT RESPONSE

                                                                     0     1  OMIT
  1ST +                                             *       1ST      2    31     0
  2ND +                                            *        2ND      3    29     0
  3RD +                                *                    3RD     10    21     0
  4TH +                        *                            4TH     19    19     0
  5TH +  *                                                  5TH     24     2     0
      +----+----+----+----+----+----+----+----+----+----+
      0    10   20   30   40   50   60   70   80   90   100 PROP  0.36  0.64  0.00
                                                            RPBI -0.59  0.59  0.00

ITEM  11      PERCENT OF CORRECT RESPONSE BY FIFTHS         MATRIX OF RESPONSES BY FIFTHS                  1 IS CORRECT RESPONSE

                                                                     0     1  OMIT
  1ST +                                             *       1ST      2    31     0
  2ND +                                               *     2ND      1    31     0
  3RD +                       *                             3RD     16    15     0
  4TH +                              *                      4TH     14    24     0
  5TH +    *                                                5TH     23     3     0
      +----+----+----+----+----+----+----+----+----+----+
      0    10   20   30   40   50   60   70   80   90   100 PROP  0.35  0.65  0.00
                                                            RPBI -0.60  0.60  0.00

ITEM  12      PERCENT OF CORRECT RESPONSE BY FIFTHS         MATRIX OF RESPONSES BY FIFTHS                  1 IS CORRECT RESPONSE

                                                                     0     1  OMIT
  1ST +                                                 *   1ST      0    33     0
  2ND +                                                 *   2ND      0    32     0
  3RD +                                            *        3RD      3    28     0
  4TH +                                       *             4TH      7    31     0
  5TH +                  *                                  5TH     16    10     0
      +----+----+----+----+----+----+----+----+----+----+
      0    10   20   30   40   50   60   70   80   90   100 PROP  0.16  0.84  0.00
                                                            RPBI -0.51  0.51  0.00
```

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                        * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM  13      PERCENT OF CORRECT RESPONSE BY FIFTHS            MATRIX OF RESPONSES BY FIFTHS                  1 IS CORRECT RESPONSE

                                                                         0     1  OMIT
 1ST +                                                 *        1ST      0    33     0
 2ND +                                         *                2ND      5    27     0
 3RD +                     *                                    3RD     17    14     0
 4TH +            *                                             4TH     28    10     0
 5TH +  *                                                       5TH     24     2     0
     +----+----+----+----+----+----+----+----+----+----+
     0    10   20   30   40   50   60   70   80   90   100      PROP  0.46  0.54  0.00
                                                                RPBI -0.68  0.68  0.00

ITEM  14      PERCENT OF CORRECT RESPONSE BY FIFTHS            MATRIX OF RESPONSES BY FIFTHS                  1 IS CORRECT RESPONSE

                                                                         0     1  OMIT
 1ST +                                               *          1ST      1    32     0
 2ND +                                       *                  2ND      6    26     0
 3RD +                       *                                  3RD     16    15     0
 4TH +                 *                                        4TH     24    14     0
 5TH +      *                                                   5TH     22     4     0
     +----+----+----+----+----+----+----+----+----+----+
     0    10   20   30   40   50   60   70   80   90   100      PROP  0.43  0.57  0.00
                                                                RPBI -0.62  0.62  0.00

ITEM  15      PERCENT OF CORRECT RESPONSE BY FIFTHS            MATRIX OF RESPONSES BY FIFTHS                  1 IS CORRECT RESPONSE

                                                                         0     1  OMIT
 1ST +                                         *                1ST      5    28     0
 2ND +                                *                         2ND     11    21     0
 3RD +             *                                            3RD     22     9     0
 4TH +                 *                                        4TH     24    14     0
 5TH +*                                                         5TH     25     1     0
     +----+----+----+----+----+----+----+----+----+----+
     0    10   20   30   40   50   60   70   80   90   100      PROP  0.54  0.46  0.00
                                                                RPBI -0.55  0.55  0.00

ITEM  16      PERCENT OF CORRECT RESPONSE BY FIFTHS            MATRIX OF RESPONSES BY FIFTHS                  1 IS CORRECT RESPONSE

                                                                         0     1  OMIT
 1ST +                                        *                 1ST      6    27     0
 2ND +                                 *                        2ND     10    22     0
 3RD +                  *                                       3RD     19    12     0
 4TH +                    *                                     4TH     22    16     0
 5TH +     *                                                    5TH     23     3     0
     +----+----+----+----+----+----+----+----+----+----+
     0    10   20   30   40   50   60   70   80   90   100      PROP  0.50  0.50  0.00
                                                                RPBI -0.47  0.47  0.00
```

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                                  * * *  MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

 ITEM  17      PERCENT OF CORRECT RESPONSE BY FIFTHS           MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                        0     1  OMIT
   1ST +                                         *             1ST      5    28     0
   2ND +                                 *                     2ND     10    22     0
   3RD +                            *                          3RD     13    18     0
   4TH +              *                                        4TH     26    12     0
   5TH +    *                                                  5TH     23     3     0
       +----+----+----+----+----+----+----+----+----+----+
       0    10   20   30   40   50   60   70   80   90  100    PROP  0.48  0.52  0.00
                                                               RPBI -0.50  0.50  0.00

 ITEM  18      PERCENT OF CORRECT RESPONSE BY FIFTHS           MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                        0     1  OMIT
   1ST +                                                 *     1ST      0    33     0
   2ND +                                      *                2ND      7    25     0
   3RD +                               *                       3RD     11    20     0
   4TH +            *                                          4TH     28    10     0
   5TH +  *                                                    5TH     24     2     0
       +----+----+----+----+----+----+----+----+----+----+
       0    10   20   30   40   50   60   70   80   90  100    PROP  0.44  0.56  0.00
                                                               RPBI -0.66  0.66  0.00

 ITEM  19      PERCENT OF CORRECT RESPONSE BY FIFTHS           MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                        0     1  OMIT
   1ST +                                             *         1ST      2    31     0
   2ND +                              *                        2ND     12    20     0
   3RD +             *                                         3RD     22     9     0
   4TH +        *                                              4TH     31     7     0
   5TH *                                                       5TH     26     0     0
       +----+----+----+----+----+----+----+----+----+----+
       0    10   20   30   40   50   60   70   80   90  100    PROP  0.58  0.42  0.00
                                                               RPBI -0.65  0.65  0.00

 ITEM  20      PERCENT OF CORRECT RESPONSE BY FIFTHS           MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                        0     1  OMIT
   1ST +                                                 *     1ST      0    33     0
   2ND +                                      *                2ND      7    25     0
   3RD +                        *                              3RD     15    16     0
   4TH +                  *                                    4TH     23    15     0
   5TH *                                                       5TH     26     0     0
       +----+----+----+----+----+----+----+----+----+----+
       0    10   20   30   40   50   60   70   80   90  100    PROP  0.44  0.56  0.00
                                                               RPBI -0.67  0.67  0.00
```

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                 * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM  21     PERCENT OF CORRECT RESPONSE BY FIFTHS              MATRIX OF RESPONSES BY FIFTHS          1 IS CORRECT RESPONSE

                                                                         0     1  OMIT
 1ST +                                          *           1ST          5    28     0
 2ND +                       *                              2ND         17    15     0
 3RD +          *                                           3RD         24     7     0
 4TH +    *                                                 4TH         34     4     0
 5TH +  *                                                   5TH         24     2     0
     +----+----+----+----+----+----+----+----+----+----+
     0    10   20   30   40   50   60   70   80   90   100  PROP      0.65  0.35  0.00
                                                            RPBI     -0.58  0.58  0.00

ITEM  22     PERCENT OF CORRECT RESPONSE BY FIFTHS              MATRIX OF RESPONSES BY FIFTHS          1 IS CORRECT RESPONSE

                                                                         0     1  OMIT
 1ST +                                            *         1ST          3    30     0
 2ND +                                              *       2ND          2    30     0
 3RD +              *                                       3RD         22     9     0
 4TH +    *                                                 4TH         34     4     0
 5TH +    *                                                 5TH         23     3     0
     +----+----+----+----+----+----+----+----+----+----+
     0    10   20   30   40   50   60   70   80   90   100  PROP      0.52  0.47  0.00
                                                            RPBI     -0.69  0.69  0.00

ITEM  23     PERCENT OF CORRECT RESPONSE BY FIFTHS              MATRIX OF RESPONSES BY FIFTHS          1 IS CORRECT RESPONSE

                                                                         0     1  OMIT
 1ST +                                          *           1ST          5    28     0
 2ND +                *                                     2ND         21    11     0
 3RD +           *                                          3RD         23     8     0
 4TH +            *                                         4TH         28    10     0
 5TH *                                                      5TH         26     0     0
     +----+----+----+----+----+----+----+----+----+----+
     0    10   20   30   40   50   60   70   80   90   100  PROP      0.64  0.36  0.00
                                                            RPBI     -0.52  0.52  0.00

ITEM  24     PERCENT OF CORRECT RESPONSE BY FIFTHS              MATRIX OF RESPONSES BY FIFTHS          1 IS CORRECT RESPONSE

                                                                         0     1  OMIT
 1ST +                                        *             1ST          6    27     0
 2ND +              *                                       2ND         22    10     0
 3RD +       *                                              3RD         26     5     0
 4TH +    *                                                 4TH         34     4     0
 5TH *                                                      5TH         26     0     0
     +----+----+----+----+----+----+----+----+----+----+
     0    10   20   30   40   50   60   70   80   90   100  PROP      0.71  0.29  0.00
                                                            RPBI     -0.56  0.56  0.00
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                    * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM   25     PERCENT OF CORRECT RESPONSE BY FIFTHS                     MATRIX OF RESPONSES BY FIFTHS            1 IS CORRECT RESPONSE

                                                                                  0      1   OMIT
   1ST +                                                  *             1ST       5     28      0
   2ND +                              *                                 2ND      15     17      0
   3RD +                            *                                   3RD      16     15      0
   4TH +          *                                                     4TH      31      7      0
   5TH +     *                                                          5TH      23      3      0
       +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
       0     10    20    30    40    50    60    70    80    90    100  PROP   0.56   0.44   0.00
                                                                        RPBI  -0.53   0.53   0.00

ITEM   26     PERCENT OF CORRECT RESPONSE BY FIFTHS                     MATRIX OF RESPONSES BY FIFTHS            1 IS CORRECT RESPONSE

                                                                                  0      1   OMIT
   1ST +                                               *                1ST       6     27      0
   2ND +                                 *                              2ND      14     18      0
   3RD +                       *                                        3RD      18     13      0
   4TH +     *                                                          4TH      34      4      0
   5TH +       *                                                        5TH      22      4      0
       +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
       0     10    20    30    40    50    60    70    80    90    100  PROP   0.59   0.41   0.00
                                                                        RPBI  -0.54   0.54   0.00

ITEM   27     PERCENT OF CORRECT RESPONSE BY FIFTHS                     MATRIX OF RESPONSES BY FIFTHS            1 IS CORRECT RESPONSE

                                                                                  0      1   OMIT
   1ST +                 *                                              1ST      23     10      0
   2ND +                   *                                            2ND      21     11      0
   3RD +                  *                                             3RD      21     10      0
   4TH +     *                                                          4TH      34      4      0
   5TH +  *                                                             5TH      24      2      0
       +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
       0     10    20    30    40    50    60    70    80    90    100  PROP   0.77   0.23   0.00
                                                                        RPBI  -0.25   0.25   0.00

ITEM   28     PERCENT OF CORRECT RESPONSE BY FIFTHS                     MATRIX OF RESPONSES BY FIFTHS            1 IS CORRECT RESPONSE

                                                                                  0      1   OMIT
   1ST +                         *                                      1ST      17     15      1
   2ND +                 *                                              2ND      22     10      0
   3RD +          *                                                     3RD      25      6      0
   4TH +*                                                               4TH      37      1      0
   5TH +*                                                               5TH      25      1      0
       +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
       0     10    20    30    40    50    60    70    80    90    100  PROP   0.79   0.21   0.01
                                                                        RPBI  -0.42   0.40   0.13
                    * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM  29    PERCENT OF CORRECT RESPONSE BY FIFTHS             MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                        0      1   OMIT
  1ST +                                *                       1ST     11     22      0
  2ND +                    *                                   2ND     19     13      0
  3RD +          *                                             3RD     25      6      0
  4TH +             *                                          4TH     28     10      0
  5TH +     *                                                  5TH     23      3      0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100      PROP   0.66   0.34   0.00
                                                               RPBI  -0.41   0.41   0.00

ITEM  30    PERCENT OF CORRECT RESPONSE BY FIFTHS             MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                        0      1   OMIT
  1ST +                       *                                1ST     17     16      0
  2ND +       *                                                2ND     27      5      0
  3RD +            *                                           3RD     23      8      0
  4TH +   *                                                    4TH     35      3      0
  5TH *                                                        5TH     26      0      0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100      PROP   0.80   0.20   0.00
                                                               RPBI  -0.36   0.36   0.00

ITEM  31    PERCENT OF CORRECT RESPONSE BY FIFTHS             MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                        0      1   OMIT
  1ST +                               *                        1ST     12     21      0
  2ND +                             *                          2ND     13     19      0
  3RD +                 *                                      3RD     20     11      0
  4TH +       *                                                4TH     32      6      0
  5TH *                                                        5TH     26      0      0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100      PROP   0.64   0.36   0.00
                                                               RPBI  -0.50   0.50   0.00
```

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* * *  MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

                        MULTIPLE DISCRIM

                          KEYED SCORE

                  SUMMARY OF TEST STATISTICS

          NUMBER OF ITEMS                          27

          MEAN SCORE                            17.01

          MEDIAN SCORE                          17.83

          STANDARD DEVIATION                     5.51

          RELIABILITY (KR-20)                   0.848

          RELIABILITY (KR-21)                   0.824

          S.E. OF MEASUREMENT                    2.32

          POSSIBLE LOW SCORE                        0
          POSSIBLE HIGH SCORE                      27

          CBTAINED LOW SCORE                        1
          CBTAINED HIGH SCORE                      26

          NUMBER OF SCORES                        160
               BLANK SCORES                         0
               INVALID SCORES                       0
               VALID SCORES                       160

      SPEARMAN-BROWN PROPHESY FORMULA---IN ORDER FOR THIS
       TEST TO OBTAIN A RELIABILITY OF .90 IT MUST BE
             0.93 LONGER.  ( 25 ADDITIONAL ITEMS).
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                    * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM   1       PERCENT OF CORRECT RESPONSE BY FIFTHS        MATRIX OF RESPONSES BY FIFTHS                4 IS CORRECT RESPONSE

                                                                NO RES     1     2     3     4  OMIT
 1ST +                                                 *    1ST      0     0     0     0    40     0
 2ND +                                                 *    2ND      0     0     0     0    25     0
 3RD +                                              *       3RD      0     0     2     0    36     0
 4TH +                                    *                 4TH      1     2     3     1    21     0
 5TH +                                   *                  5TH      2     1     2     3    21     0
     +----+----+----+----+----+----+----+----+----+----+
     C   10   20   30   40   50   60   70   80   90  100    PROP  0.02  0.02  0.04  0.02  0.89  0.00
                                                            RPBI -0.21 -0.15 -0.19 -0.28  0.42  0.00

ITEM   2       PERCENT OF CORRECT RESPONSE BY FIFTHS        MATRIX OF RESPONSES BY FIFTHS                3 IS CORRECT RESPONSE

                                                                NO RES     1     2     3     4  OMIT
 1ST +                                               *      1ST      0     0     1    39     0     0
 2ND +                                                 *    2ND      0     0     0    25     0     0
 3RD +                                             *        3RD      1     1     0    35     1     0
 4TH +                                        *             4TH      1     2     1    23     1     0
 5TH +                                   *                  5TH      2     0     4    21     2     0
     +----+----+----+----+----+----+----+----+----+----+
     C   10   20   30   40   50   60   70   80   90  100    PROP  0.02  0.02  0.04  0.89  0.02  0.00
                                                            RPBI -0.25 -0.08 -0.27  0.41 -0.15  0.00

ITEM   3       PERCENT OF CORRECT RESPONSE BY FIFTHS        MATRIX OF RESPONSES BY FIFTHS                4 IS CORRECT RESPONSE

                                                                NO RES     1     2     3     4  OMIT
 1ST +                                                 *    1ST      0     0     0     0    40     0
 2ND +                                         *            2ND      0     2     2     0    21     0
 3RD +                                              *       3RD      0     2     0     0    36     0
 4TH +                                        *             4TH      0     4     1     0    23     0
 5TH +                                    *                 5TH      0     5     1     1    22     0
     +----+----+----+----+----+----+----+----+----+----+
     C   10   20   30   40   50   60   70   80   90  100    PROP  0.00  0.08  0.02  0.01  0.89  0.00
                                                            RPBI  0.00 -0.22 -0.04 -0.09  0.23  0.00

ITEM   4       PERCENT OF CORRECT RESPONSE BY FIFTHS        MATRIX OF RESPONSES BY FIFTHS                2 IS CORRECT RESPONSE

                                                                NO RES     1     2     3     4  OMIT
 1ST +                                               *      1ST      0     1    39     0     0     0
 2ND +                                                 *    2ND      0     0    25     0     0     0
 3RD +                                             *        3RD      0     1    35     2     0     0
 4TH +                                      *               4TH      1     2    22     2     1     0
 5TH +                   *                                  5TH      1     3    12     4     9     0
     +----+----+----+----+----+----+----+----+----+----+
     C   10   20   30   40   50   60   70   80   90  100    PROP  0.01  0.04  0.83  0.05  0.06  0.00
                                                            RPBI -0.15 -0.16  0.52 -0.23 -0.39  0.00
                    * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM   5   PERCENT OF CORRECT RESPONSE BY FIFTHS              MATRIX OF RESPONSES BY FIFTHS              3 IS CORRECT RESPONSE

                                                                    NO RES     1     2     3     4  OMIT
  1ST +                                               *       1ST        0     1     0    39     0     0
  2ND +                                                 *     2ND        0     0     0    25     0     0
  3RD +                                             *         3RD        0     2     0    35     1     0
  4TH +                                    *                  4TH        3     2     1    21     1     0
  5TH +                              *                        5TH        2     1     3    18     5     0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100     PROP    0.03  0.04  0.02  0.86  0.04  0.00
                                                              RPBI   -0.25 -0.08 -0.18  0.45 -0.34  0.00

ITEM   6   PERCENT OF CORRECT RESPONSE BY FIFTHS              MATRIX OF RESPONSES BY FIFTHS              1 IS CORRECT RESPONSE

                                                                    NO RES     1     2     3     4  OMIT
  1ST +                                              *        1ST        0    38     0     2     0     0
  2ND +                             *                         2ND        0    15     5     3     2     0
  3RD +                                     *                 3RD        1    29     3     3     2     0
  4TH +                           *                           4TH        0    16     5     1     6     0
  5TH +                *                                      5TH        3    10     2     8     6     0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100     PROP    0.02  0.67  0.09  0.11  0.10  0.00
                                                              RPBI   -0.20  0.42 -0.04 -0.25 -0.25  0.00

ITEM   7   PERCENT OF CORRECT RESPONSE BY FIFTHS              MATRIX OF RESPONSES BY FIFTHS              2 IS CORRECT RESPONSE

                                                                    NO RES     1     2     3     4  OMIT
  1ST +                                                 *     1ST        0     0    40     0     0     0
  2ND +                                                 *     2ND        0     0    25     0     0     0
  3RD +                                           *           3RD        0     1    34     2     1     0
  4TH +                                *                      4TH        0     1    19     3     5     0
  5TH +                     *                                 5TH        2     1    13     6     7     0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100     PROP    0.01  0.02  0.82  0.07  0.08  0.00
                                                              RPBI   -0.33 -0.15  0.56 -0.30 -0.31  0.00

ITEM   8   PERCENT OF CORRECT RESPONSE BY FIFTHS              MATRIX OF RESPONSES BY FIFTHS              1 IS CORRECT RESPONSE

                                                                    NO RES     1     2     3     4  OMIT
  1ST +                                               *       1ST        0    39     0     0     1     0
  2ND +                                               *       2ND        0    24     0     0     1     0
  3RD +                                       *               3RD        0    31     4     0     3     0
  4TH +                      *                                4TH        0    13     9     4     2     0
  5TH +                 *                                     5TH        2    11     6     3     7     0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100     PROP    0.01  0.74  0.12  0.04  0.09  0.00
                                                              RPBI   -0.33  0.56 -0.30 -0.20 -0.27  0.00
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                          * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM   9    PERCENT OF CORRECT RESPONSE BY FIFTHS           MATRIX OF RESPONSES BY FIFTHS               3 IS CORRECT RESPONSE

                                                                NO RES     1     2     3     4  OMIT
1ST +                                               *       1ST      0     0     0    39     1     0
2ND +                                           *           2ND      0     1     1    22     1     0
3RD +                                  *                    3RD      2     4     0    27     5     0
4TH +                           *                           4TH      2     2     2    16     6     0
5TH +                     *                                 5TH      6     4     1    13     5     0
    +----+----+----+----+----+----+----+----+----+----+
    0   10   20   30   40   50   60   70   80   90  100     PROP   0.06  0.07  0.02  0.73  0.11  0.00
                                                            RPBI  -0.34 -0.17 -0.09  0.48 -0.23  0.00

ITEM  10    PERCENT OF CORRECT RESPONSE BY FIFTHS           MATRIX OF RESPONSES BY FIFTHS               1 IS CORRECT RESPONSE

                                                                NO RES     1     2     3     4  OMIT
1ST +                                             *         1ST      0    37     0     2     1     0
2ND +                                           *           2ND      0    22     0     3     0     0
3RD +                                      *                3RD      2    30     1     2     3     0
4TH +                             *                         4TH      0    17     3     5     3     0
5TH +            *                                          5TH      5     8     2     6     8     0
    +----+----+----+----+----+----+----+----+----+----+
    0   10   20   30   40   50   60   70   80   90  100     PROP   0.04  0.71  0.04  0.11  0.09  0.00
                                                            RPBI  -0.29  0.50 -0.19 -0.14 -0.30  0.00

ITEM  11    PERCENT OF CORRECT RESPONSE BY FIFTHS           MATRIX OF RESPONSES BY FIFTHS               4 IS CORRECT RESPONSE

                                                                NO RES     1     2     3     4  OMIT
1ST +                                          *            1ST      1     2     2     0    35     0
2ND +                                       *               2ND      1     4     0     0    20     0
3RD +                                      *                3RD      0     4     4     0    30     0
4TH +                               *                       4TH      0     6     4     0    18     0
5TH +                       *                               5TH      3     4     1     6    15     0
    +----+----+----+----+----+----+----+----+----+----+
    0   10   20   30   40   50   60   70   80   90  100     PROP   0.03  0.13  0.07  0.04  0.74  0.00
                                                            RPBI  -0.20 -0.09 -0.04 -0.36  0.33  0.00

ITEM  12    PERCENT OF CORRECT RESPONSE BY FIFTHS           MATRIX OF RESPONSES BY FIFTHS               3 IS CORRECT RESPONSE

                                                                NO RES     1     2     3     4  OMIT
1ST +                                             *         1ST      1     1     0    37     1     0
2ND +                                           *           2ND      2     1     0    22     0     0
3RD +                                     *                 3RD      2     4     2    29     1     0
4TH +                      *                                4TH      0     6     5    13     4     0
5TH +                *                                      5TH      5     7     2    10     5     0
    +----+----+----+----+----+----+----+----+----+----+
    0   10   20   30   40   50   60   70   80   90  100     PROP   0.06  0.12  0.06  0.69  0.07  0.00
                                                            RPBI  -0.23 -0.27 -0.16  0.50 -0.20  0.00
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                        * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM  13      PERCENT OF CORRECT RESPONSE BY FIFTHS         MATRIX OF RESPONSES BY FIFTHS                4 IS CORRECT RESPONSE

                                                                NO RES     1     2     3     4  OMIT
1ST +                                  *                    1ST      2     5     3     2    28     0
2ND +                     *                                 2ND      0     5     2     7    11     0
3RD +                         *                             3RD      1     5     5     7    20     0
4TH +               *                                       4TH      1     3     9     6     9     0
5TH +       *                                               5TH      4     8     5     7     5     0
    +----+----+----+----+----+----+----+----+----+----+
    0   10   20   30   40   50   60   70   80   90  100     PROP  0.05  0.16  0.15  0.18  0.46  0.00
                                                            RPBI -0.21 -0.11 -0.16 -0.11  0.37  0.00

ITEM  14      PERCENT OF CORRECT RESPONSE BY FIFTHS         MATRIX OF RESPONSES BY FIFTHS                2 IS CORRECT RESPONSE

                                                                NO RES     1     2     3     4  OMIT
1ST +                                        *              1ST      1     0    33     5     1     0
2ND +                                         *             2ND      0     0    21     3     1     0
3RD +                                   *                   3RD      0     1    28     9     0     0
4TH +                      *                                4TH      0     0    13    10     5     0
5TH +           *                                           5TH      4     8     8     8     1     0
    +----+----+----+----+----+----+----+----+----+----+
    0   10   20   30   40   50   60   70   80   90  100     PROP  0.03  0.06  0.64  0.22  0.05  0.00
                                                            RPBI -0.29 -0.30  0.43 -0.13 -0.14  0.00

ITEM  15      PERCENT OF CORRECT RESPONSE BY FIFTHS         MATRIX OF RESPONSES BY FIFTHS                2 IS CORRECT RESPONSE

                                                                NO RES     1     2     3     4  OMIT
1ST +                                         *             1ST      2     0    34     1     3     0
2ND +                               *                       2ND      2     1    16     3     3     0
3RD +                             *                         3RD      3     4    23     3     5     0
4TH +       *                                               4TH      3     7     5     5     8     0
5TH +       *                                               5TH      4     7     5     6     7     0
    +----+----+----+----+----+----+----+----+----+----+
    0   10   20   30   40   50   60   70   80   90  100     PROP  0.09  0.12  0.52  0.11  0.16  0.00
                                                            RPBI -0.20 -0.27  0.53 -0.18 -0.18  0.00

ITEM  16      PERCENT OF CORRECT RESPONSE BY FIFTHS         MATRIX OF RESPONSES BY FIFTHS                4 IS CORRECT RESPONSE

                                                                NO RES     1     2     3     4  OMIT
1ST +                                       *               1ST      0     5     0     3    32     0
2ND +                                       *               2ND      0     3     0     2    20     0
3RD +                             *                         3RD      0    13     1     1    23     0
4TH +                      *                                4TH      0     8     0     7    13     0
5TH +            *                                          5TH      5     7     0     9     8     0
    +----+----+----+----+----+----+----+----+----+----+
    0   10   20   30   40   50   60   70   80   90  100     PROP  0.03  0.22  0.01  0.14  0.60  0.00
                                                            RPBI -0.41 -0.12 -0.03 -0.27  0.45  0.00
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                  * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM  17     PERCENT OF CORRECT RESPONSE BY FIFTHS                 MATRIX OF RESPONSES BY FIFTHS                3 IS CORRECT RESPONSE

                                                                           NO RES     1     2     3     4  OMIT
 1ST +                                         *                   1ST          0     0     4    34     2     0
 2ND +                               *                             2ND          2     2     2    16     3     0
 3RD +                                      *                      3RD          1     1     4    30     2     0
 4TH +                  *                                          4TH          2     5     9    11     1     0
 5TH +              *                                              5TH          6     3     9     9     2     0
     +----+----+----+----+----+----+----+----+----+----+
     0    10   20   30   40   50   60   70   80   90  100          PROP      0.07  0.07  0.17  0.63  0.06  0.00
                                                                   RPBI     -0.33 -0.15 -0.23  0.41  0.03  0.00

ITEM  18     PERCENT OF CORRECT RESPONSE BY FIFTHS                 MATRIX OF RESPONSES BY FIFTHS                2 IS CORRECT RESPONSE

                                                                           NO RES     1     2     3     4  OMIT
 1ST +                                   *                         1ST          0     6    29     2     3     0
 2ND +                     *                                       2ND          1     2    11     6     5     0
 3RD +                 *                                           3RD          2    10    14     6     6     0
 4TH +                           *                                 4TH          1     3    16     4     4     0
 5TH +       *                                                     5TH          4     8     5     5     7     0
     +----+----+----+----+----+----+----+----+----+----+
     0    10   20   30   40   50   60   70   80   90  100          PROP      0.05  0.18  0.47  0.14  0.16  0.00
                                                                   RPBI     -0.24 -0.11  0.31 -0.03 -0.14  0.00

ITEM  19     PERCENT OF CORRECT RESPONSE BY FIFTHS                 MATRIX OF RESPONSES BY FIFTHS                2 IS CORRECT RESPONSE

                                                                           NO RES     1     2     3     4  OMIT
 1ST +                                   *                         1ST          0     2    29     4     5     0
 2ND +                                       *                     2ND          0     1    20     4     0     0
 3RD +              *                                              3RD          1     2    12    10    13     0
 4TH +                *                                            4TH          1     4    10     7     6     0
 5TH +                 *                                           5TH          4     4    11     3     7     0
     +----+----+----+----+----+----+----+----+----+----+
     0    10   20   30   40   50   60   70   80   90  100          PROP      0.04  0.08  0.51  0.17  0.19  0.00
                                                                   RPBI     -0.31 -0.13  0.35 -0.07 -0.13  0.00

ITEM  20     PERCENT OF CORRECT RESPONSE BY FIFTHS                 MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                           NO RES     1     2     3     4  OMIT
 1ST +                                            *                1ST          1    36     1     0     2     0
 2ND +                               *                             2ND          3    16     1     3     2     0
 3RD +                 *                                           3RD          1    14     6     7    10     0
 4TH +             *                                               4TH          2     8     4     6     8     0
 5TH +    *                                                        5TH          5     3     6    11     4     0
     +----+----+----+----+----+----+----+----+----+----+
     0    10   20   30   40   50   60   70   80   90  100          PROP      0.07  0.48  0.11  0.17  0.16  0.00
                                                                   RPBI     -0.24  0.54 -0.17 -0.27 -0.14  0.00
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                                            * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM  21    PERCENT OF CORRECT RESPONSE BY FIFTHS                     MATRIX OF RESPONSES BY FIFTHS                    3 IS CORRECT RESPONSE

                                                                            NO RES     1     2     3     4  OMIT
 1ST +                                       *                        1ST        3     2     8    27     0     0
 2ND +                                   *                            2ND        3     4     1    15     2     0
 3RD +                *                                               3RD        2     6    14    11     5     0
 4TH +             *                                                  4TH        2     1    12     7     6     0
 5TH +         *                                                      5TH        6     3     7     5     8     0
     +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
     0    10    20    30    40    50    60    70    80    90   100    PROP    0.10  0.10  0.26  0.41  0.13  0.00
                                                                      RPBI   -0.19  0.01 -0.08  0.37 -0.28  0.00

ITEM  22    PERCENT OF CORRECT RESPONSE BY FIFTHS                     MATRIX OF RESPONSES BY FIFTHS                    1 IS CORRECT RESPONSE

                                                                            NO RES     1     2     3     4  OMIT
 1ST +                                                     *          1ST        0    36     1     2     1     0
 2ND +                                          *                     2ND        0    18     2     3     2     0
 3RD +                              *                                 3RD        2    20     1     8     7     0
 4TH +                                 *                              4TH        2    16     2     3     5     0
 5TH +              *                                                 5TH        3     8     3     6     9     0
     +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
     0    10    20    30    40    50    60    70    80    90   100    PROP    0.04  0.61  0.06  0.14  0.15  0.00
                                                                      RPBI   -0.26  0.41 -0.07 -0.10 -0.26  0.00

ITEM  23    PERCENT OF CORRECT RESPONSE BY FIFTHS                     MATRIX OF RESPONSES BY FIFTHS                    2 IS CORRECT RESPONSE

                                                                            NO RES     1     2     3     4  OMIT
 1ST +                                                *               1ST        1     0    33     5     1     0
 2ND +                                          *                     2ND        1     1    18     2     3     0
 3RD +                              *                                 3RD        1     4    20     7     6     0
 4TH +               *                                                4TH        0     5     8     5    10     0
 5TH +       *                                                        5TH        6     5     4     4    10     0
     +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
     0    10    20    30    40    50    60    70    80    90   100    PROP    0.06  0.09  0.52  0.14  0.19  0.00
                                                                      RPBI   -0.31 -0.22  0.52 -0.05 -0.28  0.00

ITEM  24    PERCENT OF CORRECT RESPONSE BY FIFTHS                     MATRIX OF RESPONSES BY FIFTHS                    1 IS CORRECT RESPONSE

                                                                            NO RES     1     2     3     4  OMIT
 1ST +                                                *               1ST        1    33     3     3     0     0
 2ND +                                   *                            2ND        3    15     3     3     1     0
 3RD +              *                                                 3RD        1    10    18     4     5     0
 4TH +               *                                                4TH        2     8     5     3    10     0
 5TH *                                                                5TH        5     0     8    12     4     0
     +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
     0    10    20    30    40    50    60    70    80    90   100    PROP    0.07  0.41  0.23  0.16  0.13  0.00
                                                                      RPBI   -0.23  0.53 -0.14 -0.21 -0.21  0.00
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                    * * *  MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE  * * *

ITEM  25     PERCENT OF CORRECT RESPONSE BY FIFTHS            MATRIX OF RESPONSES BY FIFTHS            3 IS CORRECT RESPONSE

                                                                    NO RES      1      2      3      4   OMIT
  1ST +                                        *              1ST        2      1      5     32      0      0
  2ND +                                    *                  2ND        0      1      4     18      2      0
  3RD +                     *                                 3RD        4      5      8     16      5      0
  4TH +       *                                               4TH        3      7      7      5      6      0
  5TH +*                                                      5TH        8      7      7      1      6      0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100     PROP    0.11   0.13   0.19   0.45   0.12   0.00
                                                              RPBI   -0.30  -0.23  -0.11   0.59  -0.26   0.00

ITEM  26     PERCENT OF CORRECT RESPONSE BY FIFTHS            MATRIX OF RESPONSES BY FIFTHS            2 IS CORRECT RESPONSE

                                                                    NO RES      1      2      3      4   OMIT
  1ST +                                    *                  1ST        3      2     29      3      3      0
  2ND +                       *                               2ND        2      1     12      5      5      0
  3RD +                 *                                     3RD        1      5     14      8     10      0
  4TH +           *                                           4TH        3      9      7      5      4      0
  5TH +       *                                               5TH        4      5      5      5     10      0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100     PROP    0.08   0.14   0.42   0.16   0.20   0.00
                                                              RPBI   -0.18  -0.20   0.39  -0.05  -0.13   0.00

ITEM  27     PERCENT OF CORRECT RESPONSE BY FIFTHS            MATRIX OF RESPONSES BY FIFTHS            1 IS CORRECT RESPONSE

                                                                    NO RES      1      2      3      4   OMIT
  1ST +                                        *              1ST        1     32      1      3      3      0
  2ND +                              *                        2ND        0     15      1      6      3      0
  3RD +              *                                        3RD        2     12     10      3     11      0
  4TH +       *                                               4TH        0      5      8      6      9      0
  5TH +  *                                                    5TH        3      2      4     15      5      0
      +----+----+----+----+----+----+----+----+----+----+
      0   10   20   30   40   50   60   70   80   90  100     PROP    0.04   0.41   0.15   0.21   0.19   0.00
                                                              RPBI   -0.18   0.54  -0.15  -0.28  -0.15   0.00
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* * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

                      CONCEPT DEVELOPMENT

                        KEYED SCORE ,

                  SUMMARY OF TEST STATISTICS

          NUMBER OF ITEMS                          23

          MEAN SCORE                            12.09

          MEDIAN SCORE                          12.65

          STANDARD DEVIATION                     4.80

          RELIABILITY (KR-20)                   0.825

          RELIABILITY (KR-21)                   0.785

          S.E. OF MEASUREMENT                    2.22

          POSSIBLE LOW SCORE                        0
          POSSIBLE HIGH SCORE                      23

          OBTAINED LOW SCORE                        0
          OBTAINED HIGH SCORE                      22

          NUMBER OF SCORES                        160
               BLANK SCORES                         0
               INVALID SCORES                       0
               VALID SCORES                       160

      SPEARMAN-BROWN PROPHESY FORMULA---IN ORDER FOR THIS
       TEST TO OBTAIN A RELIABILITY OF .90 IT MUST BE
            1.46 LONGER.  ( 34 ADDITIONAL ITEMS).
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                    * * *  MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM   1     PERCENT OF CORRECT RESPONSE BY FIFTHS        MATRIX OF RESPONSES BY FIFTHS              3 IS CORRECT RESPONSE

                                                              NO RES     1     2     3     4  OMIT
1ST +                                                 *   1ST      0     0     0    35     0     0
2ND +                                              *      2ND      1     0     0    32     1     0
3RD +                                          *          3RD      0     3     1    25     0     0
4TH +                                              *      4TH      2     0     0    35     0     0
5TH +                       *                             5TH      7     2     1    12     3     0
    +----+----+----+----+----+----+----+----+----+----+
    0   10   20   30   40   50   60   70   80   90  100    PROP  0.06  0.03  0.01  0.87  0.02  0.00
                                                          RPBI -0.40 -0.12 -0.10  0.44 -0.14  0.00

ITEM   2     PERCENT OF CORRECT RESPONSE BY FIFTHS        MATRIX OF RESPONSES BY FIFTHS              1 IS CORRECT RESPONSE

                                                              NO RES     1     2     3     4  OMIT
1ST +                                                 *   1ST      0    35     0     0     0     0
2ND +                                           *         2ND      0    31     0     1     2     0
3RD +                                          *          3RD      0    25     1     0     3     0
4TH +                                       *             4TH      1    30     0     4     2     0
5TH +                        *                            5TH      3    13     4     4     1     0
    +----+----+----+----+----+----+----+----+----+----+
    0   10   20   30   40   50   60   70   80   90  100    PROP  0.02  0.84  0.03  0.06  0.05  0.00
                                                          RPBI -0.32  0.41 -0.21 -0.21 -0.08  0.00

ITEM   3     PERCENT OF CORRECT RESPONSE BY FIFTHS        MATRIX OF RESPONSES BY FIFTHS              3 IS CORRECT RESPONSE

                                                              NO RES     1     2     3     4  OMIT
1ST +                                               *     1ST      1     0     0    34     0     0
2ND +                                                 *   2ND      0     0     0    34     0     0
3RD +                                               *     3RD      0     1     0    28     0     0
4TH +                                   *                 4TH      2     4     0    28     3     0
5TH +            *                                        5TH      5     8     1     7     4     0
    +----+----+----+----+----+----+----+----+----+----+
    0   10   20   30   40   50   60   70   80   90  100    PROP  0.05  0.08  0.01  0.82  0.04  0.00
                                                          RPBI -0.34 -0.33 -0.15  0.60 -0.26  0.00

ITEM   4     PERCENT OF CORRECT RESPONSE BY FIFTHS        MATRIX OF RESPONSES BY FIFTHS              2 IS CORRECT RESPONSE

                                                              NO RES     1     2     3     4  OMIT
1ST +                                  *                  1ST      1     4    25     1     4     0
2ND +                                     *               2ND      4     0    26     1     2     1
3RD +                                   *                 3RD      1     5    21     2     0     0
4TH +                     *                               4TH      3    10    17     4     3     0
5TH +               *                                     5TH      5     7     8     3     2     0
    +----+----+----+----+----+----+----+----+----+----+
    0   10   20   30   40   50   60   70   80   90  100    PROP  0.09  0.16  0.61  0.07  0.07  0.01
                                                          RPBI -0.24 -0.17  0.32 -0.14  0.02  0.05
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                  * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM   5    PERCENT OF CORRECT RESPONSE BY FIFTHS              MATRIX OF RESPONSES BY FIFTHS              2 IS CORRECT RESPONSE

                                                                     NO RES     1     2     3     4  OMIT
 1ST +                                               *         1ST        1     0    34     0     0     0
 2ND +                                     *                   2ND        0     6    26     1     1     0
 3RD +                                   *                     3RD        2     1    21     3     2     0
 4TH +        *                                                4TH        1    14     7     1    14     0
 5TH +         *                                               5TH        6     8     5     4     2     0
      +----+----+----+----+----+----+----+----+----+----+
      0    10   20   30   40   50   60   70   80   90   100    PROP    0.06  0.18  0.58  0.06  0.12  0.00
                                                               RPBI   -0.35 -0.27  0.59 -0.12 -0.23  0.00

ITEM   6    PERCENT OF CORRECT RESPONSE BY FIFTHS              MATRIX OF RESPONSES BY FIFTHS              3 IS CORRECT RESPONSE

                                                                     NO RES     1     2     3     4  OMIT
 1ST +                                     *                   1ST        3     1     0    27     4     0
 2ND +                         *                               2ND        2     3     4    18     7     0
 3RD +                               *                         3RD        1     1     3    19     5     0
 4TH +                 *                                       4TH        1    12     4    14     6     0
 5TH +     *                                                   5TH        6     9     5     3     2     0
      +----+----+----+----+----+----+----+----+----+----+
      0    10   20   30   40   50   60   70   80   90   100    PROP    0.08  0.16  0.10  0.51  0.15  0.00
                                                               RPBI   -0.23 -0.30 -0.13  0.41  0.03  0.00

ITEM   7    PERCENT OF CORRECT RESPONSE BY FIFTHS              MATRIX OF RESPONSES BY FIFTHS              4 IS CORRECT RESPONSE

                                                                     NO RES     1     2     3     4  OMIT
 1ST +                                              *          1ST        2     0     0     0    33     0
 2ND +                               *                         2ND        1     1     5     5    22     0
 3RD +                                 *                       3RD        1     3     2     3    20     0
 4TH +                       *                                 4TH        2     3     4    10    18     0
 5TH +       *                                                 5TH        6     1     3    11     4     0
      +----+----+----+----+----+----+----+----+----+----+
      0    10   20   30   40   50   60   70   80   90   100    PROP    0.07  0.05  0.09  0.18  0.61  0.00
                                                               RPBI   -0.29 -0.10 -0.08 -0.31  0.49  0.00

ITEM   8    PERCENT OF CORRECT RESPONSE BY FIFTHS              MATRIX OF RESPONSES BY FIFTHS              4 IS CORRECT RESPONSE

                                                                     NO RES     1     2     3     4  OMIT
 1ST +                                           *             1ST        0     1     1     2    31     0
 2ND +                                         *               2ND        0     0     1     4    29     0
 3RD +                            *                            3RD        3     5     2     2    17     0
 4TH +                       *                                 4TH        2     6     3     8    18     0
 5TH +               *                                         5TH        6     6     0     5     8     0
      +----+----+----+----+----+----+----+----+----+----+
      0    10   20   30   40   50   60   70   80   90   100    PROP    0.07  0.11  0.04  0.13  0.64  0.00
                                                               RPBI   -0.37 -0.23  0.00 -0.15  0.45  0.00
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                   * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM  9     PERCENT OF CORRECT RESPONSE BY FIFTHS          MATRIX OF RESPONSES BY FIFTHS                    1 IS CORRECT RESPONSE

                                                           NO RES     1     2     3     4  OMIT
1ST +                                               *      1ST      0    33     1     0     1     0
2ND +                                         *            2ND      0    28     2     0     4     0
3RD +                                  *                   3RD      1    20     2     2     4     0
4TH +                       *                              4TH      3    18     1     4    11     0
5TH +           *                                          5TH      6     6     4     4     5     0
    +----+----+----+----+----+----+----+----+----+----+
    0   10   20   30   40   50   60   70   80   90  100    PROP   0.06  0.66  0.06  0.06  0.16  0.00
                                                           RPBI  -0.41  0.53 -0.11 -0.23 -0.20  0.00

ITEM 10     PERCENT OF CORRECT RESPONSE BY FIFTHS          MATRIX OF RESPONSES BY FIFTHS                    4 IS CORRECT RESPONSE

                                                           NO RES     1     2     3     4  OMIT
1ST +                                      *               1ST      0     4     2     2    27     0
2ND +                             *                        2ND      0     5     4     4    21     0
3RD +                               *                      3RD      1     4     3     2    19     0
4TH +                       *                              4TH      1     5     8     5    18     0
5TH +       *                                              5TH      6     2     9     4     4     0
    +----+----+----+----+----+----+----+----+----+----+
    0   10   20   30   40   50   60   70   80   90  100    PROP   0.05  0.13  0.16  0.11  0.56  0.00
                                                           RPBI  -0.43  0.04 -0.22 -0.10  0.39  0.00

ITEM 11     PERCENT OF CORRECT RESPONSE BY FIFTHS          MATRIX OF RESPONSES BY FIFTHS                    2 IS CORRECT RESPONSE

                                                           NO RES     1     2     3     4  OMIT
1ST +                                                 *    1ST      0     0    35     0     0     0
2ND +                                              *       2ND      0     1    32     1     0     0
3RD +                                    *                 3RD      1     4    22     0     2     0
4TH +                                  *                   4TH      0     3    26     3     5     0
5TH +       *                                              5TH      5     7     4     5     4     0
    +----+----+----+----+----+----+----+----+----+----+
    0   10   20   30   40   50   60   70   80   90  100    PROP   0.04  0.09  0.74  0.06  0.07  0.00
                                                           RPBI  -0.39 -0.29  0.61 -0.24 -0.21  0.00

ITEM 12     PERCENT OF CORRECT RESPONSE BY FIFTHS          MATRIX OF RESPONSES BY FIFTHS                    3 IS CORRECT RESPONSE

                                                           NO RES     1     2     3     4  OMIT
1ST +                                         *            1ST      1     4     0    30     0     0
2ND +                             *                        2ND      0    10     2    21     1     0
3RD +                          *                           3RD      2     9     1    16     1     0
4TH +                   *                                  4TH      3    10     4    15     5     0
5TH +       *                                              5TH      7     7     3     4     4     0
    +----+----+----+----+----+----+----+----+----+----+
    0   10   20   30   40   50   60   70   80   90  100    PROP   0.08  0.25  0.06  0.54  0.07  0.00
                                                           RPBI  -0.35 -0.11 -0.14  0.47 -0.23  0.00
                   * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM  13     PERCENT OF CORRECT RESPONSE BY FIFTHS          MATRIX OF RESPONSES BY FIFTHS             4 IS CORRECT RESPONSE

                                                                 NO RES     1     2     3     4  OMIT
 1ST +                                     *                1ST        1     1     3     3    27     0
 2ND +                        *                             2ND        2     7     2     6    17     0
 3RD +                     *                                3RD        2     5     0     9    13     0
 4TH +                *                                     4TH        4     4     7     9    13     0
 5TH +           *                                          5TH        7     7     2     3     6     0
     +----+----+----+----+----+----+----+----+----+----+
     0   10   20   30   40   50   60   70   80   90  100    PROP    0.10  0.15  0.09  0.19  0.47  0.00
                                                            RPBI   -0.32 -0.14 -0.07 -0.08  0.39  0.00

ITEM  14     PERCENT OF CORRECT RESPONSE BY FIFTHS          MATRIX OF RESPONSES BY FIFTHS             3 IS CORRECT RESPONSE

                                                                 NO RES     1     2     3     4  OMIT
 1ST +                                        *             1ST        0     2     4    29     0     0
 2ND +                               *                      2ND        3     4     1    22     4     0
 3RD +            *                                         3RD        3     6     4     8     8     0
 4TH +   *                                                  4TH        4    12    11     3     7     0
 5TH +   *                                                  5TH        9     2     8     2     4     0
     +----+----+----+----+----+----+----+----+----+----+
     0   10   20   30   40   50   60   70   80   90  100    PROP    0.12  0.16  0.17  0.40  0.14  0.00
                                                            RPBI   -0.38 -0.12 -0.21  0.61 -0.15  0.00

ITEM  15     PERCENT OF CORRECT RESPONSE BY FIFTHS          MATRIX OF RESPONSES BY FIFTHS             3 IS CORRECT RESPONSE

                                                                 NO RES     1     2     3     4  OMIT
 1ST +                                  *                   1ST        0     3     3    25     4     0
 2ND +                        *                             2ND        2     8     2    17     5     0
 3RD +            *                                         3RD        3     6     6     8     6     0
 4TH +        *                                             4TH        6    11     1     7    12     0
 5TH +                                                      5TH        7     8     2     0     8     0
     +----+----+----+----+----+----+----+----+----+----+
     0   10   20   30   40   50   60   70   80   90  100    PROP    0.11  0.22  0.09  0.36  0.22  0.00
                                                            RPBI   -0.36 -0.13  0.04  0.49 -0.19  0.00

ITEM  16     PERCENT OF CORRECT RESPONSE BY FIFTHS          MATRIX OF RESPONSES BY FIFTHS             2 IS CORRECT RESPONSE

                                                                 NO RES     1     2     3     4  OMIT
 1ST +                                              *       1ST        1     0    33     1     0     0
 2ND +                                                      2ND        1     0    26     7     0     0
 3RD +                               *                      3RD        2     0    19     8     0     0
 4TH +                    *                                 4TH        0     2    16    14     5     0
 5TH +       *                                              5TH        6     2     4     9     4     0
     +----+----+----+----+----+----+----+----+----+----+
     0   10   20   30   40   50   60   70   80   90  100    PROP    0.06  0.02  0.61  0.24  0.06  0.00
                                                            RPBI   -0.33 -0.15  0.54 -0.24 -0.24  0.00
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                        * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM  17    PERCENT OF CORRECT RESPONSE BY FIFTHS                     MATRIX OF RESPONSES BY FIFTHS                2 IS CORRECT RESPONSE

                                                                          NO RES     1     2     3     4  OMIT
  1ST +                                                *              1ST      0     0    29     6     0     0
  2ND +                                                 *             2ND      2     1    29     2     0     0
  3RD +                             *                                 3RD      2     2    15     7     3     0
  4TH +                       *                                       4TH      3     9    15     2     8     0
  5TH +           *                                                   5TH      6     4     5     5     5     0
      +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
      0     10    20    30    40    50    60    70    80    90    100 PROP  0.08  0.10  0.58  0.14  0.10  0.00
                                                                      RPBI -0.35 -0.22  0.49  0.01 -0.28  0.00

ITEM  18    PERCENT OF CORRECT RESPONSE BY FIFTHS                     MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                          NO RES     1     2     3     4  OMIT
  1ST +                                                *              1ST      0    29     3     2     1     0
  2ND +                                     *                         2ND      1    22     2     3     6     0
  3RD +                    *                                          3RD      3    11     6     6     3     0
  4TH +     *                                                         4TH      3     4     5    10    15     0
  5TH + *                                                             5TH      6     1     5     8     5     0
      +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
      0     10    20    30    40    50    60    70    80    90    100 PROP  0.08  0.42  0.13  0.18  0.19  0.00
                                                                      RPBI -0.36  0.59 -0.10 -0.22 -0.19  0.00

ITEM  19    PERCENT OF CORRECT RESPONSE BY FIFTHS                     MATRIX OF RESPONSES BY FIFTHS                4 IS CORRECT RESPONSE

                                                                          NO RES     1     2     3     4  OMIT
  1ST +                                           *                   1ST      2     1     3     3    26     0
  2ND +                             *                                 2ND      1     4     8     4    17     0
  3RD +                    *                                          3RD      5     5     4     4    11     0
  4TH +                   *                                           4TH      5     6     8     5    13     0
  5TH *                                                               5TH     10     5     6     4     0     0
      +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
      0     10    20    30    40    50    60    70    80    90    100 PROP  0.14  0.13  0.18  0.13  0.42  0.00
                                                                      RPBI -0.36 -0.15 -0.06 -0.07  0.45  0.00

ITEM  20    PERCENT OF CORRECT RESPONSE BY FIFTHS                     MATRIX OF RESPONSES BY FIFTHS                1 IS CORRECT RESPONSE

                                                                          NO RES     1     2     3     4  OMIT
  1ST +                                   *                           1ST      2    21     0     6     6     0
  2ND +                   *                                           2ND      3    12     5     7     7     0
  3RD +      *                                                        3RD      4     4    12     6     3     0
  4TH +      *                                                        4TH      2     5    16     6     8     0
  5TH +   *                                                           5TH      6     2     4     6     7     0
      +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
      0     10    20    30    40    50    60    70    80    90    100 PROP  0.11  0.27  0.23  0.19  0.19  0.00
                                                                      RPBI -0.22  0.39 -0.18 -0.02 -0.06  0.00
                        * * *   MERMAC -- TEST ANALYSIS AND QUESTIONNAIRE PACKAGE   * * *

ITEM  21     PERCENT OF CORRECT RESPONSE BY FIFTHS            MATRIX OF RESPONSES BY FIFTHS                    1 IS CORRECT RESPONSE

                                                                     NO RES    1     2     3     4   OMIT
   1ST +                *                                     1ST       4     10     9     9     3     0
   2ND +                *                                     2ND       3     10     4     9     8     0
   3RD +      *                                               3RD       4      3     6     8     8     0
   4TH +*                                                     4TH       6      1    12    14     4     0
   5TH +          *                                           5TH      10      4     3     7     1     0
       +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
       0    10    20    30    40    50    60    70    80    90   100    PROP     0.17  0.17  0.21  0.29  0.15  0.00
                                                              RPBI    -0.29  0.25  0.01 -0.02  0.05  0.00

ITEM  22     PERCENT OF CORRECT RESPONSE BY FIFTHS            MATRIX OF RESPONSES BY FIFTHS                    2 IS CORRECT RESPONSE

                                                                     NO RES    1     2     3     4   OMIT
   1ST +                        *                             1ST       6     11    14     2     2     0
   2ND +                 *                                    2ND       5      7    10     7     5     0
   3RD +          *                                           3RD       4      6     5     2    12     0
   4TH +     *                                                4TH       5     13     3     8     8     0
   5TH +              *                                       5TH       6      4     6     1     8     0
       +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
       0    10    20    30    40    50    60    70    80    90   100    PROP     0.16  0.26  0.24  0.13  0.22  0.00
                                                              RPBI    -0.14  0.06  0.19  0.00 -0.15  0.00

ITEM  23     PERCENT OF CORRECT RESPONSE BY FIFTHS            MATRIX OF RESPONSES BY FIFTHS                    4 IS CORRECT RESPONSE

                                                                     NO RES    1     2     3     4   OMIT
   1ST +                    *                                 1ST       3      7     1    12    12     0
   2ND +        *                                             2ND       0      9     4    16     5     0
   3RD +       *                                              3RD       4      3     3    15     4     0
   4TH +          *                                           4TH       3      4    17     7     6     0
   5TH + *                                                    5TH       7      4     4     9     1     0
       +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
       0    10    20    30    40    50    60    70    80    90   100    PROP     0.11  0.17  0.18  0.37  0.17  0.00
                                                              RPBI    -0.28  0.11 -0.20  0.08  0.22  0.00
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VITA

Mack L. Bowen was born August 31, 1943, in Beaverton, Alabama. He attended elementary schools in Lamar County, Alabama, and high school in Sulligent, Alabama. He graduated from high school in 1962. He attended the University of Alabama, where he received his Bachelor of Science degree in 1965, and the Master of Arts degree in special education in 1967. He has served as a teacher in classes for the educable mentally handicapped in Jefferson County, Alabama, and Partlow State School, Alabama. Other experience included work as reading consultant to various school systems in Alabama and Georgia, and research assistant, Institute for Research on Exceptional Children, University of Illinois. In 1968 he was awarded a U. S. Office of Education fellowship for advanced graduate work at the University of Illinois where he worked toward the doctorate in special education. He is a member of the American Educational Research Association, the Council for Exceptional Children, the National Association of School Psychologists, Phi Delta Kappa and Kappa Delta Pi.